INTERFACE AGE™

MICROCOMPUTING FOR SMALL BUSINESS AND HOME VOLUME 2, ISSUE 10, OCTOBER 1977 $1.75
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CIRCLE INQUIRY NO. 43

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CIRCLE INQUIRY NO. 6

VOL. 2, ISSUE 11 OCTOBER 1977

INTERFACE AGE™

MICROCOMPUTING FOR HOME AND THE SMALL BUSINESSMAN

COVER STORY

The hometown of INTERFACE AGE, Cerritos, California, means hillocks in Spanish. We can assume that the original Land Grant families who named it possessed a wry sense of humor for the terrain is the flattest of plains! The name evoked in Merrilyn Joyce's mind the whimsy portraying of the imaginary hills embossed with our old logo while the rising sun carries the new design in its rays. Our name remains unchanged; only the design has been altered to give more legibility to the word "AGE" which had previously been tucked in the lower niche of the last "E" of "INTERFACE."

The composition resembles a Tarot card symbolizing this month's theme: the weather and the environment.

FEATURES

BUSINESS FEATURES

SOFTWARE FEATURES

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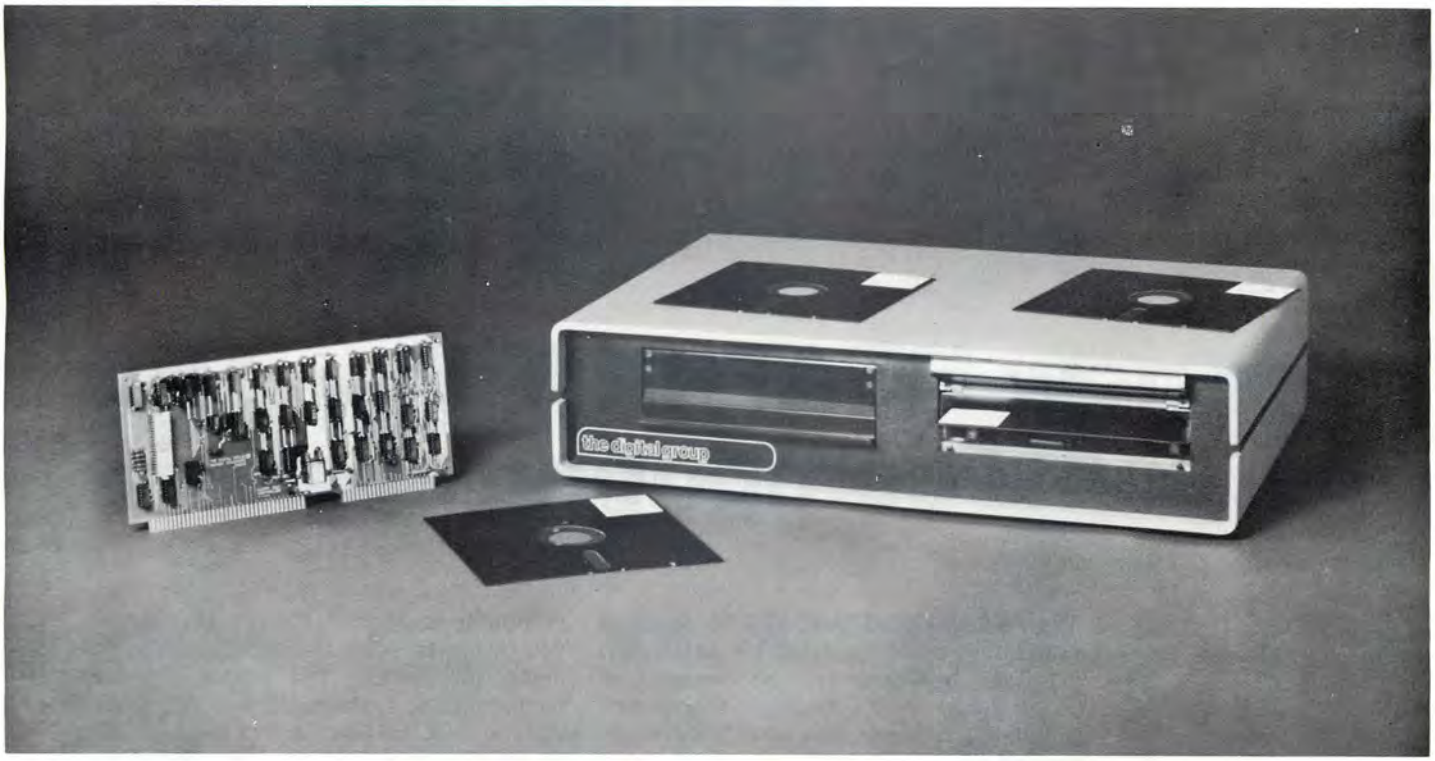

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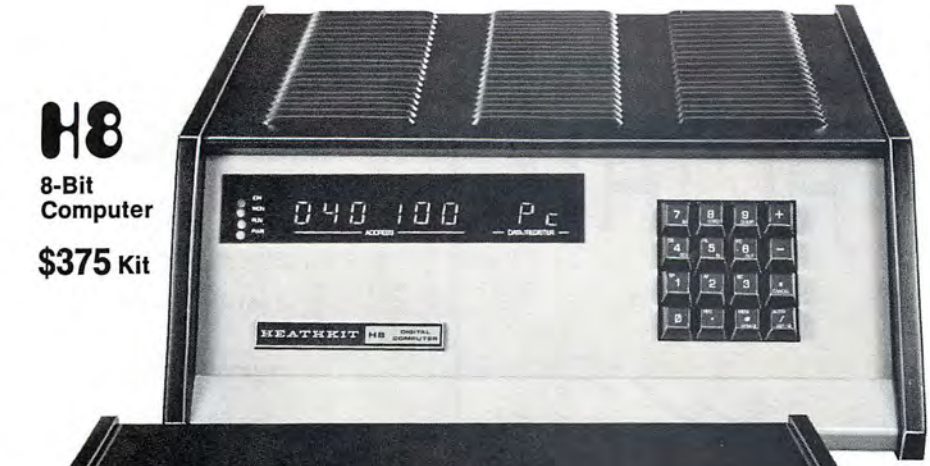

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INTERFACIAL

Some years ago a French scholar, Jean Sendy propounded the theory that the "Elohim", whom he identifies with visitors from Space, found this planet in the grip of an Ice Age and with their superior technology successfully reversed the cooling trend enabling the native stock to develop the fundamental tools necessary to civilization: husbandry and agriculture.

Whether the dynamic atmospheric forces were altered or not remains a subject of romance and speculation. However, the hard facts compiled sometimes painfully over the span of human history indicate that climate's effect upon civilization is not negligible. Our ancestors had only frail control over the environment through stockpiling of fuel and food and building comfortable shelters to wait out the season's inclemencies. Modern humanity fares only somewhat better applying the same methods. In the last decades the gains are largely cancelled out by the ever-increasing population load on the biosphere.

Our only net gain has been in the field of information. Environmental dynamics are now extensively recorded and relatively well understood. Weather information is disseminated to every region of the globe and these data are stored for future use. The introduction of the small computer has greatly facilitated the gathering of individual blocks of data for later integration into larger systems. The U.S. Weather Service reports on its network of small and large data bases in COMPUTERS THAT TALK ABOUT THE WEATHER while Dr. Brock and his colleagues at the National Center for Atmospheric Research report on NCAR's portable system for gathering regional weather data.

Such facts together with others on depletion of non-renewable resources can be usefully manipulated for prediction purposes. Joan Melcher and Dr. Amend report on this art in their companion articles on the Energy/Environment Simulators.

Dr. John W. Mauchly in his guest editorial suggests that the home computerist should apply his hand also in resource simulation. Dr. Mauchly is one of the Founding Fathers of the Computer Age, one who has watched the technology expand and diffuse into every capillary of the national corpus. Since INTERFACE AGE is still a young publication, we are very proud to have received contributions from worthies such as Dr. Mauchly and Dr. C. Lester Hogan (March Issue) and we thank them for it.

Recently much controversy has arisen regarding the effect of noise on the environment. There is no simple answer yet, but Tim O'Shaughnessy gives you a sample program to work out this problem for yourself.

The Hardware Section has been temporarily replaced by a Business Section which features Part II of Bud Shamburger's GENERAL LEDGER PACKAGE and Roger Garrett concludes his STAR-SHIP SIMULATION with the logic flow of structured programming. Meanwhile Ed Keith shows you how to apply structured programming to Assembly Language.

To better understand the "environment" of your own personality, put your micro to work plotting your biorhythm. You may be astounded at the results. Biorhythm plotting, like Astrology, are easy subjects for hobby programming. We publish programs on those themes for that reason only. The publication of programs of these themes does not imply endorsement on our part.

—L.F.-S.

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CIRCLE INQUIRY NO. 34

LETTERS TO THE EDITOR

Dear Editor:

The article "Star Lanes" by Steven Faber in your June issue was of interest to me in that many of the ideas in the program are generally applicable to programs for board games. The large amount of description of how the program works was very useful.

Reading through the program I found a number of simplifications which should reduce the size of the program and make it possible for memory-limited users to use it.

First I changed the numerical assignments of the galactic matrix M(I,J) so that the values 1 through 5 are assigned to the shipping companies in correspondence with the values for S1, Q, and M$. This eliminates the need for Lines 1060 to 1063, 1318, 1319, 1321 and 1322 as well as a lot of adding and subtracting in 3 other lines.

One of the interesting general features of the program is that the matrix M(I,J) is dimensioned from 0 through 10 in I and 0 through 12 in J although only 1 through 9 and 1 through 11 are actually in the galaxy. This has the effect of producing a board surrounded by a border of zeroes, so that off-board points look as if they were unoccupied space. Thus when testing the neighbors of a point, it is unnecessary to make a special case of edge points and have statements testing for them. This also explains the necessity for my Line 65.

Second, I noticed that A1 through A4 are not simply temporary variables, as you state, but refer always to the neighbors of a point on the galactic map. I changed these to an array A(1) through A(4) which made it possible to change many bulky statements to single ones in a "FOR" loop done four times. It also made it possible to compare the neighbors to each other by the usual method of doing the combinations of four things taken two at a time (my Line 415), instead of writing out all six combinations (Faber's Lines 420 to 470).

Much other unnecessary testing was eliminated by calculating the minimum of the A array and using it in several places as well as remembering which companies merge and not testing for mergers again at the beginning of subroutine Line 1060.

There follows a list of changes, which I believe to be comprehensive and correct. However, this list of changes is not tested or debugged, as I have neither the hardware nor BASIC version to do so.

INTERFACE AGE June 1977, p. 138 "Star Lanes". Change M(i,j) codes so that

M(i,j) = 1 means Altair Starways
M(i,j) = 2 means Betelgeuse, Ltd.
" = 5 means Eridani . See p. 131
" = 6 Star
" = 7 Unatt. Outpost
" = 8 Unoccupied

```
400  A(1) = M(R-I,C) : A(2) = . . .
                                  A(4) = M(R,C-I)
405  M1 = 8 : FOR I = 1 TO 4 IF A(I)<MI
     THEN MI = A(I) NEXT I
     THIS FINDS FINDS MIN OF A(I)'S
410  IF M1>7 THEN M(R,C) = 7 : GO TO 800
415  FOR I = 1 TO 3 : FOR J = I + 1 TO 4
420  IF (AI)<6 and A(J)<6 AND A(I)<>A(J)
430  THEN GO SUB 1060 : NEXT J,I
THESE 3 LINES DO ALL THE MERGER TEST-
ING, SO ELIMINATE LINES 440 TO 470
412  IF M1>5 THEN 660 [REPLACES LINE 480]
     HERE WE REUSE THE MINIMUM COM-
     PUTED IN LINE 405
500-530  DELETED. THESE ARE NOT NEEDED
     SINCE WE STILL HAVE THE MINIMUM
540  Q(MI) = Q(MI) + 1 : S1(MI) = S1(MI) + 100 :
     M(R,C) = M1 : GO TO 700
670  NEXT I : IF M(R,C)>6 THEN M(R,C) = 7 :
     GO TO 800
700  FOR J = 1 TO 4 IF A(J) = 6 THEN S1(MI) =
     S1(MI) + 500
710  IFA(J) = 7 THEN S1(MI) = S1(MI) + 100 :
     Q(MI) = Q(MI) + 1
720  NEXT J                [DELETE 430]
740  IF A(1) = 7 THEN M(R-I,C) = M1
     [AND SIMILARLY NEXT 3 LINES]
780  IF SI(M1)> = 3000 THEN T1 = M1 :
     GO SUB 1400
790  M(R,C) = M1
```

Now we know that the A(I) and A(J) are the lanes to be merged so we need only determine which has the most quantity Q.

```
1060 TI = A(I) :              X = A(J) :
1080 IF Q(TI)<Q(X) THEN X = T1 : TI = A(J) :
```

Since we remembered the I & J we need not do all the testing so we can eliminate everything else from 1060 to 1170 inclusive. The return at 1370 will do for both subroutines.

```
1310 FOR I = 1 TO 9 FOR J = 1 TO 12
     IF M(I,J) = X
     THEN M(I,J) = T1
     MANY CHANGES SIMILAR TO THE
     ABOVE ELIMINATION OF 3'S IN 1310
     WILL NEED TO BE MADE TO COMPEN-
     SATE FOR THE M CODE CHANGES
DELETE 1318, 1319, 1321 and 1322
110  . . . THEN M(I,J) = 8
120  M(I,J) = 6
65   FOR I = 0 TO 10 : FOR J = 0 TO 13
     M(I,J) = 9 NEXT I,J
67   DIM A(4)
100  L$ = "ABCDE• + •" : M$ = SAME
250  NEXT I,1 : IF M(R(I),C(I))<8 THEN 230
270  NEXT I1              DELETE 280
290  A(1) = M(R(I)-1,C(I)) : A(2) = M(R(I) + 1,C(I))
300  A(3) = M(R(I),C(I) + 1) : A(4) = M(R(I),C(I)-1)
310  FOR J = 1 TO 4
320  IF A(J)<6 THEN 340
     THIS TAKES CARE OF LINES 270 & 280
     (THE PROPOSED MOVE IS OK SINCE IT
     WILL ADD TO A COMPANY OR MERGE)
330  IF A(J)<8 THEN 230
     THIS LINE ELIMINATES MOVES NEXT
     TO A'6 OR 7 (STAR OR UNATTACHED
     OUTPOST) AND REPLACES LINES
     310-337
335  NEXT J
```

Charles A. Plantz
Tucson, Arizona

Dear Editor:

I was just introduced to microcomputers a month ago and I'm amazed at the capability. The choices involved in obtaining a system, however, are difficult. A lot depends on whether you talk to a salesman or a user.

My needs are basically for accounting purposes, Accounts Receivable, Payroll, General Ledger, and eventually patient records and third party billing.

However, I would certainly want to be able also to use the medical applications, e.g. EKG Hookup etc, that may be available in the future. But is the S-100 bus going to become obsolete? the work in the Boston Labs is done using the 8080 systems. The LSI-11 and available

DEC programs looks quite interesting because of the software available and the price.

I'm not into the technical aspects of construction hence could only deal with an assembled unit with service available. I would be quite interested in hearing from any physicians who have systems and their applications. Please start my subscription with the August issue. May I say categorically that the industry should get off of the printers that have the computer type print. It should be modified to look like regular type, i.e. selectric. The sooner this is done the better.

Your magazine is quite enjoyable. "From the Fountainhead" by Osborne is very good. I'm afraid to make a major investment with the T.I. Magnetic Bubble units coming on the scene. Would they be compatible with the Altair, for example, if I were to get one now? Could I put two or three of the PET 2001 units (cheap) in different locations in my health center as terminals for an Altair or T.I. CPU? Help!

I would suspect as more and more people become interested in the field — as I am sure they will — they will want assembled operable units with service. The companies should be well aware of this and plan accordingly.

This is my first letter to an editor. It won't be the last. This is a fascinating field.

Jonathan C. Gibbs, Jr., M.D.
Memorial Health Center
75 Harrison Avenue
Jersey City, NJ 07304

We are publishing this physicians's address so that readers may contact him to exchange problems and solutions. —*Editor*

REPLY TO FOUNTAINHEAD

Dear Mr. Osborne:

I can state emphatically from personal experience that there are very definitely two sides to the "kit electronics" question, and the "good vs. bad vendor" question as well.

First, the good news:

I purchased four 4K RAM kits from S.D. Sales, in Texas. As I remember, they were about $90.00 each — quite a bargain per bit! The boards were fully socketed, solder masked, silk screened, and used the 21L02 chips . . . an excellent board, and good design as well. All but *one* of the boards functioned perfectly upon assembly, and the defect in the non-functioning board was *not* a bad chip, but a bridge underneath the solder mask. In several helpful conversations with Ewing (of S.D. Sales) it was determined that it would be best to send the board to them for repair. I did so, and got the repaired board back (almost!) by return mail! This is an excellent company!

Now, for the *bad* news:

It took me *months* of letters, telephone calls, and conversations with my attorney to finally get my initial investment back from a (deliberately un-named) company in Illinois that sells surplus Baudot I/O typewriters. I feel fortunate to have gotten the cost of the unit — I know there's no way I could ever get my other costs (attorney, phone, *time*, etc.) from an outfit like this one. Caveat emptor really applies with a vengeance!

Keep up the good work! I enjoy your column (even though the title does turn me off a bit — seems egocentric) and the magazine as a whole.

G. Louis Roberts
Astoria, Oregon

Thanks for your input. Your complaints help eliminate abuses. The squeaky wheel and all that!

—*Editor*

Dear Editor:

In reviewing the article "Computing the Positions and Orbits of the Planets" of the August issue, the following errors were observed:

On page 49:

A_i = Angle of planet Pi with respect to Aries (Mars)

Corrected reads

A_i = Angle of planet Pi with respect to Aries

On page 50:

The missing Pi terms of Table 1 are:

PLANET	P_i
MERCURY	P1
VENUS	P2
EARTH	P3
MARS	P4
JUPITER	P5
SATURN	P6
URANUS	P7

The corrected column headings for Table 2 are:

PLANET	P_i	A_i (Corrected)	D_i

The corrected equation for Z is:

$Z = (A2-A3)$

The corrected equation for X is:

$$X = \{ \text{angle for which the Sin (X)} = \frac{D2 \cdot \text{Sin (Z)}}{Q} \}$$

On page 52:

The corrected equation for C_i is:

$$C_i = a_i \text{ Sin } (A_i - b_i)$$

The author apologizes for any inconvenience that have resulted from errors in this article.

Timothy O'Shaughnessy
Burbank, CA

Thanks for writing, Tim. We share your apology to our readers for these errors, as some of them were ours. Hard as we all try, sometimes the gremlins sneak one by us.

—*Editor*

"My daddy's computer can beat your daddy's computer."

UPDATE

INTRODUCING THE FIRST "ELECTRONIC JOURNAL"

The Washington Amateur Computer Society (WACS), has become the first computer club to make its newsletter available to anyone with a standard modem and a display device. The Journal is stored as a free access text file on the DEC-System-10 of the Catholic University of America. Although it should be used only during non-business hours (late at night or weekends), there is no account number or "password" needed.

To obtain the Journal electronically, use the following procedure: dial up (for 110 baud, (202) 635-5710; for 300 baud, (202) 635-5730); when the system answers with its whistle, insert the phone handset into the acoustic coupler with modem active and type a Control-C (X'03'); if the system is up it will respond with an up-arrow and a 'C'. Next type an 'I' followed by a carriage return. The system will send its introductory message: "CATHOLIC U. . . .", do a carriage return and send a period. At this time you should enter 'HELP WACS' and do a carriage return and the system will begin sending the Journal. To end the output at any time, simply type a Control-O (X'0F'), after which you may simply hang up the phone.

It is suggested that if you are calling long distance or using a CRT display, then you should store the Journal on cassette tape. That way you can read through the material at your own pace or come back to it at a later time. Correspondence should be addressed to: Robert Jones, Director, Washington Amateur Computer Society, 4201 Massachusetts Avenue, #168, Washington, DC 20016. If a response is expected, please include a self-addressed, stamped envelope.

PERCOMP '78 ISSUES CALL FOR PAPERS

A call for papers has been issued by James H. Lindwedel, technical program chairman, of PERCOMP '78 which will be held April 28-30, 1978 at the Long Beach Convention Center, Long Beach, California.

PERCOMP '78 is a selling show designed with the home computerist and business person in mind. 180 dealers will be present and it is estimated that the exposition will attract 12,000 to 15,000 persons. Its high visibility in the personal computing community makes PERCOMP '78 an ideal place to present microcomputer ideas and contributions.

An outstanding technical program featuring distinguished speakers is planned and there will be three full days of conferences, seminars, lectures and demonstrations.

Technical papers are encouraged in the following general areas of interest:

- Ham Radio Communications or Computer and Amateur Radio
- Speech Synthesis and Recognition
- Pattern Recognition
- Music Generation
- Programmed Learning Applications
- Bit-Slice Architecture
- Real-Time Machine Control
- Software Tutorials
- Business Applications
- Selection of a Microcomputer
- Microcomputer Hardware Surveys
- Games
- Graphic Systems
- System Expansion
- Word Processing
- IC Testing
- Hardware Tutorials
- Home Applications

Three copies of paper abstracts, in English, of an original paper in any of the above-mentioned or related areas, are requested by October 31, 1977. Include: author's name, company affiliation, complete return address and telephone number. Mail to James H. Lindwedel, PERCOMP '78, 1833 E. Seventeenth Street, Ste. 108, Santa Ana, CA 92701.

Authors will be notified of acceptance by November 30, 1977. Final manuscripts and accompanying illustrations must be received by the Technical Program Chairman by January 13, 1978. Complimentary registration is provided to each principal author.

ACM'77 ANNUAL CONFERENCE SET FOR SEATTLE, OCTOBER 17-19

The Association for Computing Machinery will hold its Annual Conference — ACM '77 — in Seattle, Washington, October 17-19 at the Olympic Hotel. Attendees at the conference will be able to sample from a wide variety of ideas and to concentrate on one or more specialties. In-depth information can be explored in such areas as databases or software engineering (a software engineering mini-conference is being conducted), computer graphics, hardware architecture, (minis, micros, or large scale memories), and computer aided instruction. In addition, less technically oriented areas will cover computer personnel turnover, the Freedom of Information Act, a database standardization report, and long range computer planning.

For registration forms and further information on the conference and its technical program, call Harvey Z. Kriloff, technical program chairman, (206) 773-0567, or James S. Ketchel, general chairman ACM '77, (206) 623-4987 or (206) 935-6776. For further information on the commercial exhibits and presentations contact: Michael Rose, ACM '77 exhibits, (206) 235-3022 or Lawrence Gaylord, special events chairman, (206) 655-8892.

SPECIAL INTEREST GROUP CHARTERED BY THE ASSOCIATION FOR COMPUTING MACHINERY

The Association for Computing Machinery chartered a new Special Interest Group on Personal Computing, SIGPC, at the National Computer Conference in June. SIGPC will be operated exclusively for educational and scientific purposes in the design and applications of computer systems for personal uses.

Dr. Portia Isaacson, who chaired the 1977 National Computer Conference, has been appointed chairperson of SIGPC. Dr. Isaacson's immediate plans for SIGPC include appointment of other officers, publication of a quarterly newsletter, and holding SIGPC's first business meeting at ACM '77 in Seattle.

To join SIGPC write to the Association for Computing Machinery, P.O. Box 12105, Church Street Station, New York, New York 10249. The dues (which include a subscription to the newsletter) are: $5.00/year for Members, associates, and student members of the ACM (please include ACM member number); $13.00/year for non-ACM members. A newsletter subscription without membership is $1200/year. For ACM members, dues are payable when ACM membership is renewed. Non-ACM members and subscribers must pay the full amount at the time that they join SIGPC.

For further information on SIGPC programs, contact Dr. Portia Isaacson, The Micro Store, 634 South Central Expressway, Richardson, TX 75080, (214) 231-1096.

take a close look at PERIPHERAL VISION

Peripheral Vision is a young, fast-moving company that's dedicated to selling reasonably priced peripherals for various manufacturers' CPU's.

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Also in the works are many new products we'll be letting you know about soon, if you'd like to take a closer look. Like I/O cards, tape drives, an impact printer--all for the S-100 BUS--and we're designing peripherals for a lot of other CPU's too.

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CIRCLE INQUIRY NO. 35

CALENDAR

OCTOBER

Oct 1 Computer Hobbyist Group, 1:00 P.M. Green Center Room 2.530, campus of University of Texas, Dallas.

Oct 1 South Central Kansas Amateur Computer Association, 9:00 A.M., Wichita Public Library, Wichita, KS. For further information call Chris Borger at (316) 265-1120 or Dave Rawson, 1825 Gary, Wichita, KS 67219, (316) 744-1629.

Oct 1 Louisville Area Computer Club will meet in the Speed Auditorium at the University of Louisville at 1:00 P.M. Call Glen Darwin at (502) 426-3344 for more details.

Oct 2 Trace will hold its meeting at the Ontario Science Center, 2:00 P.M., 770 Don Mills Road, Don Mills, Ontario.

Oct 3 Minnesota Computer Society, TCTH, 7:30 P.M., Brown Institute, Room 51, 3123 E. Lake St., Minneapolis, MN.

Oct 4 Sacramento Microcomputer Users Group, (SMUG), 7:30-9:30 P.M. at SMUD Training Bldg., 59 St. between Folsom and "S" Sts. Write Richard Lerseth, P.O. Box 161513 or call (916) 381-0335 after 5:00 P.M.

Oct 5 Valley Computer Club holds its meetings at 7:00 P.M. at the Harvard School, 3700 Coldwater Canyon Avenue, Studio City, CA.

Oct 5 Kitchener Waterloo Microcomputer Club meets at 7:00 P.M. Room 3388, Bldg. of Engineering #4, University of Waterloo, Canada.

Oct 5 Amateur Computer Society of Columbus will meet at 7:30 P.M., Center of Science and Industry. For further information call Fred Hatfield, President, (614) 486-3347.

Oct 5 New England Computer Society will be meeting the first Wednesday of each month in the cafeteria of the MITRE Corp. at 7:00 P.M., located on Rt. 62 in Bedford, MA. Contact Dave Day at (603) 434-4239 for details.

Oct 6 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward RVC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 P.M. For further details write BAMUG, 1211 Santa Clara Avenue, Alameda, CA 94501.

Oct 7 Crescent City Computer Club will hold its meeting at the University of New Orleans, Lakefront Campus at 8 P.M. Call Bob Latham at (504) 722-6321 for more details.

Oct 7 Northern New Jersey Amateur Computer Club (NNJACC) will hold its meeting at the Fairleigh Dickenson University, on the Rutherford Campus, Becton Hall, Room B8. This meeting will begin at 6:30 P.M. For more information contact NNJACC, 593 New York Avenue, Lyndhurst, NJ 07071.

Oct 8 Oklahoma Computer Club will hold its meeting at the Belle Aisle Library at 10:00 A.M. Call Al Campbell for details.

Oct 8 The Permian Basin Computer Group — Odessa Chapter meets at 1 P.M. in the Electronic Technology Bldg., Room 203 on the Odessa College campus. For

further information call (915) 332-9151.

Oct 9 North Orange County Computer Club will have its meeting at Chapman College, Orange, CA. Doors open at 12:00. 1-5 Hashinger Hall Auditorium. Membership Chairman, Tracey Lerocker, (714) 998-9722 evenings.

Oct 9 Trace will hold its meeting at the Ontario Science Center, 2:00 P.M., 770 Don Mills Road, Don Mills, Ontario.

Oct 10 Arizona Computer Society meets on Tuesday at 7:00, Room 226, DeVry Institute, 4702 N. 24th St., Phoenix, Arizona.

Oct 12 Homebrew Computer Club meeting will begin at 7 P.M. in Menlo Park, CA. The Stanford Linear Accelerator Center Auditorium is the site of the meeting. Call (415) 967-6754 for details.

Oct 13 Mid America Computer Hobbyist meeting will be at 7:00 P.M. at Commercial Federal Savings and Loan, Bellevue NE. Intersection of Galvin Rd. and U.S. Hwy. 73-75. Write P.O. Box 13303, Omaha, NE 68113 for further information.

Oct 15 The Computer Hobbyist Group meets at 1:00 P.M. in Room 108 at University of Texas (Dallas campus). For further information write P.O. Box 1344, Grand Prairie, TX 75051.

Oct 16 Chicago Area Computer Hobbyist Exchange (CACHE) will meet at 12:00 P.M. in the Nigas Bldg. Cafeteria. The Nigas Bldg. is located on Schermer Rd. in Glenview, IL. Call CACHE Hotline (312) 849-1132 for complete details.

Oct 20 Space Coast Microcomputer Club will hold its meeting at 7:30 P.M. at the Merritt Island Library, Merritt Island, FL. Contact Ray Lockwood at (305) 452-2159 for details.

Oct 20 Mid America Computer Hobbyist meets at 7:00 P.M. at Commercial Federal Savings and Loan, Bellevue NE. Intersection of Galvin Rd. and U.S. Hwy. 73-75. Write P.O. Box 13303, Omaha, NE 68113 for further information.

Oct 21 Humber College (N. Campus), Rexdale, Ontario, Canada. Room J209 at 8:00 P.M. For further information write Trace, 545 Streetsville, Ontario, Canada L5M2C1.

Oct 25 Sacramento Microcomputer Users Group (SMUG) will meet from 7:30-9:30 P.M. at the SMUD Training Bldg. between 59th and Folsom Blvd. For further information write P.O. Box 161513, Sacramento, CA 95816.

Oct 26 Ventura County Computer Society meets at 7:30 P.M. in the Camarillo Public Library, located at 3100 Ponderosa Drive, Camarillo, CA. For more information write VCCS, P.O. Box 525, Port Hueneme, CA 93041 or call (805) 985-1631 or 486-8087.

Oct 28 Washington Amateur Computer Society has scheduled its meeting to be held at the Catholic University of America, St. Johns Hall. Located at Michigan and Harewood Aves. in Washington, D.C. Contact Bill Stewart at (202) 722-0210 for club details.

See Sol here...

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(205) 979-0707

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Tempe, AZ 85281
(602) 894-1129

Byte Shop Phoenix
12654 N. 28th Dr.
Phoenix, AZ 85029
(602) 942-7300

Byte Shop Tucson
2612 E. Broadway
Tucson, AZ 85716
(602) 327-4579

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The Byte Shop
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Berkeley, CA 94703
(415) 845-6366

Computer Center
1913 Harbor Blvd.
Costa Mesa, CA 92627
(714) 646-0221

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4670 N. El Capitan
Fresno, CA 93711
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Bits 'N Bytes
679 S. State College Blvd.
Fullerton, CA 92631
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The Byte Shop
16508 Hawthorne Blvd.
Lawndale, CA 90260
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Opamp/Computer
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Los Angeles, CA 90038
(213) 934-3566

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624 West Katella #10
Orange, CA 92667
(714) 633-1222

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San Francisco, CA 94103
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San Jose, CA 95124
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Sunnyvale, CA 94087
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Van Nuys, CA 91411
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Westminster, CA 92683
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Englewood, CO 80110
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Miami, FL 33155
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Microcomputer
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144 So. Dale Mabry Hwy.
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GEORGIA

Atlanta Computer Mart
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Atlanta, GA 30340
(404) 455-0647

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Evanston, IL 60201
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42 West Roosevelt
Lombard, IL 60148
(312) 620-5808

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The Data Domain
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Bloomington, IN 47401
(812) 334-3607

The Byte Shop
5947 East 82nd St.
Indianapolis, IN 46250
(317) 842-2983

Computers Unlimited
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Indianapolis, IN 46256
(317) 849-6505

The Data Domain
7027 N. Michigan Rd.
Indianapolis, IN 46268
(317) 251-3139

IOWA

The Computer Store
of Davenport
616 West 35th Street
Davenport, IA 52806
(319) 386-3334

KENTUCKY

The Data Domain
3028 Hunsinger Lane
Louisville, KY 40220
(502) 456-5242

MICHIGAN

The Computer Store
of Ann Arbor
310 East Washington
Ann Arbor, MI 48104
(313) 995-7616

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Royal Oak, MI 48073
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General Computer Store
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Troy, MI 48084
(313) 362-0022

MINNESOTA

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3515 W. 70th St.
Minneapolis, MN 55435
(612) 927-5601

NEW JERSEY

Hoboken Computer Works
No. 20 Hudson Place
Hoboken, NJ 07030
(201) 420-1644

The Computer Mart
of New Jersey
501 Route 27
Iselin, NJ 08830
(201) 283-0600

NEW YORK

The Computer Mart
of Long Island
2072 Front Street
East Meadow, L.I. NY 11554
(516) 794-0510

The Computer Shoppe
444 Middle Country Rd.
Middle Island, NY 11953
(516) 732-4446

The Computer Mart
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118 Madison Ave.
New York, NY 10001
(212) 686-7923

The Computer Corner
200 Hamilton Ave.
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Dayton, OH 45409
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(503) 484-1040

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Portland, OR 97201
(503) 223-3496

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Houston, TX 77063
(713) 977-0664

Computertex
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Houston, TX 77006
(713) 526-3456

Interactive Computers
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Houston, TX 77036
(713) 772-5257

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4902 - 34th Street
Lubbock, TX 79410
(806) 743-2787

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Richardson, TX 75080
(214) 231-1096

VIRGINIA

The Computer Systems
Store
1984 Chain Bridge Rd.
McLean, VA 22101
(703) 821-8333

Media Reactions Inc.
11303 South Shore Dr.
Reston, VA 22090
(703) 471-9330

The Home Computer Center
2927 Virginia Beach Blvd.
Virginia Beach, VA 23452
(804) 340-1977

WASHINGTON

Byte Shop Computer Store
14701 N.E. 20th Ave.
Bellevue, WA 98007
(206) 746-0651

The Retail Computer Store
410 N.E. 72nd
Seattle, WA 98115
(206) 524-4101

WISCONSIN

Madison Computer Store
1910 Monroe St.
Madison, WI 53711
(608) 255-5552

The Milwaukee
Computer Store
6916 W. North Ave.
Milwaukee, WI 53213
(414) 259-9140

CANADA

Trintronics
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Place Bell Canada
Ottawa, Ontario K2P 2C4
(613) 236-7767

First Canadian
Computer Store Ltd.
44 Eglinton Ave. West
Toronto, Ontario M4R 1A1
(416) 482-8080

The Computer Place
186 Queen St. West
Toronto, Ontario M5V 1Z1
(416) 598-0262

Pacific Computer Store
4509-11 Rupert St.
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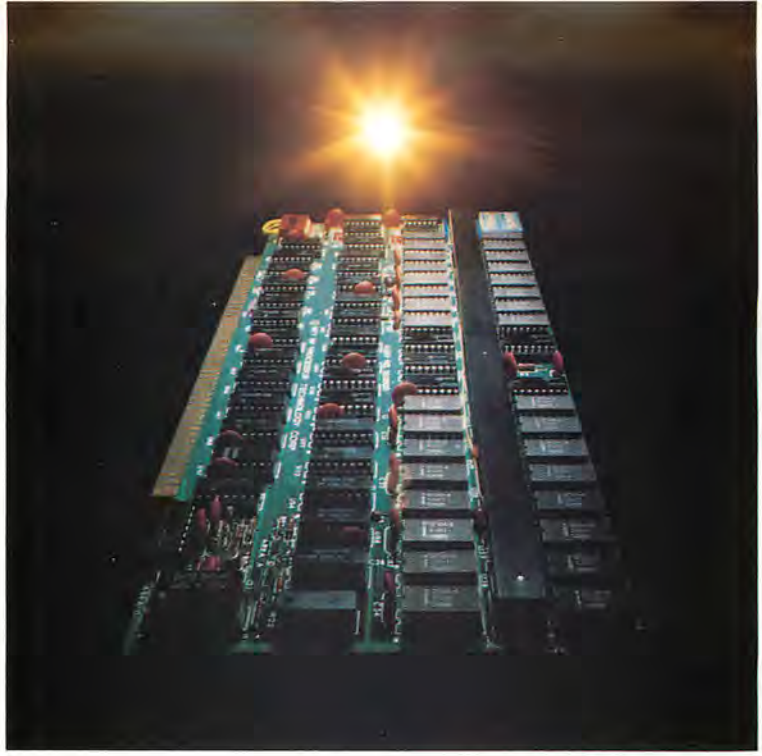
(604) 438-3282

Processor Technology



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You'll have a 16,384 byte memory with a better price performance ratio than anything on the market today. Now you can afford to add quality, high density memory to your system for remarkably little. And you can add enough to solve complex computing problems right in the main frame.

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The 16KRA Memory is Processor's first step in adding more fun, capability and reliability to your computer system at lower cost. Other modules are on the way to your dealer now. Come on down today.

Or you may contact us directly. Please address Processor Technology Corporation, Box G, 7100 Johnson Industrial Drive, Pleasanton, California 94566. Phone (415) 829-2600.

ProcessorTechnology

CIRCLE INQUIRY NO. 37

THE JURISPRUDENT COMPUTERIST

By Elliott MacLennon, J.D.
Stephan Murtha

This column is the second of two on raising capital for the business. The first dealt briefly with the two basic ways of financing a business, debt and equity, and talked briefly about the tax and security laws relating to them. This column has a more strategic emphasis in that we will try to give some sources of capital for the business, and the best method to approach these sources.

There are some general considerations which should be taken care of before approaching anyone for capital. The thoroughness with which you attend to these requirements may make the difference between having investors and not having investors.

The first step is to make out a business plan. You must decide what you are going to make, to whom you are going to sell it, for how much is it going to sell. It must be determined what plant and equipment are necessary to make your product, how many employees will you need, where you will locate your place of business. You must also make some financial projections such as an initial balance sheet and *pro forma* income statements for as far as you can reasonably foresee in the future. In short you must think of and have a documented answer to every question an investor might have, before you talk to your potential investors.

There are a number of people who could help you with this project. The first, and most important is your attorney. A good attorney, specializing in business law, will have experience in this matter. If you have not chosen the nearest state or federal penitentiary for the headquarters of your new business, his advice should be sought out first, since failure to complete certain requirements before soliciting investors can put you in violation of federal and state securities laws.

The next person is your accountant. For purposes of drafting a business plan, an accountant who does the books for small businesses should be sought out. A CPA is typically involved in tax planning and preparing financial statements and is not involved in the daily operation of the business. It may, however, be helpful to have a CPA check over and approve the tax and financial aspects of the final plan.

The final source would be the many federal, state, and local government agencies set up to aid small business. These range from the Small Business Administration on the federal level, to business development agencies run by cities and counties to promote the development of industry in their area. Also, don't overlook private organizations. For example, in our area, the American Jewish Congress has an Experience Reserve Bank in which professionals in the area volunteer their time and expertise to help small businesses get started and grow. There are numerous organizations like this all over the country.

There are many sources of investors for the small business. These sources all have different objectives and requirements which may dictate which sources should be approached, and in what order. However, all of these sources should be looked into so that the maximum amount of capital may be secured at the most attractive terms. Your potential sources of capital will fall into one of the following categories:

1. Self Funding
2. Friends, Relatives, etc.
3. Venture Capital Companies
4. Governmental Development Programs
5. Institutional Investors

The remainder of this column will deal with each of these categories individually to discuss the pros and cons of each of these possible sources.

SELF FUNDING: Self funding, or bootstrapping, is the most common method of funding a new business, and yet most businesses adopt it not by plan but by accident. By breaking the company into product lines and using the profits from the previous product to finance the next product, a company can build itself up to a good size. By outlining the eventual products you want to produce, and determining the best order from a financial point of view, it may be then possible to rearrange the order and create capital.

As with all other methods of financing a business, self funding has its pros and cons. In terms of control it is the best possible way to go from the owner's point of view. There are no outsiders to please and no special rules and regulations with which to contend. The only drawback in this method — with the exception of a very few businesses — it will not generate enough capital and at some time or another, additional methods must be used in order to get the capital which the business will need to survive.

FRIENDS, RELATIVES, ETC.: This is the second most common source of capital for the new business. The business owners will call upon people they know either to lend money or become investors in the business. This can be an excellent source of capital for the new business. This often makes available capital that would not have been made available by investors who did not personally know the principals. As with any other investor, the decision must be made whether this money should be taken as debt or equity, and the factors discussed in the previous column apply to this discussion.

At this point a word of caution is

in order. When dealing with friends and relatives, utmost care must be taken to insure that no corners are cut when setting up the business plan and the operations in the early stages. Since statistically your business will not make it, and your investors will lose their money, any detail missed along the way could later become a point of contention which could put a serious strain on a personal relationship. It is best to have an independent attorney or accountant, someone not working for anyone involved with the business, audit the progress of the formation to avoid possible future problems of this ilk. Another potential problem in dealing with people you know is to make sure that if there is an equity offering, that these people have the business sophistication to pass the state and federal securities laws dealing with this form of wealth.

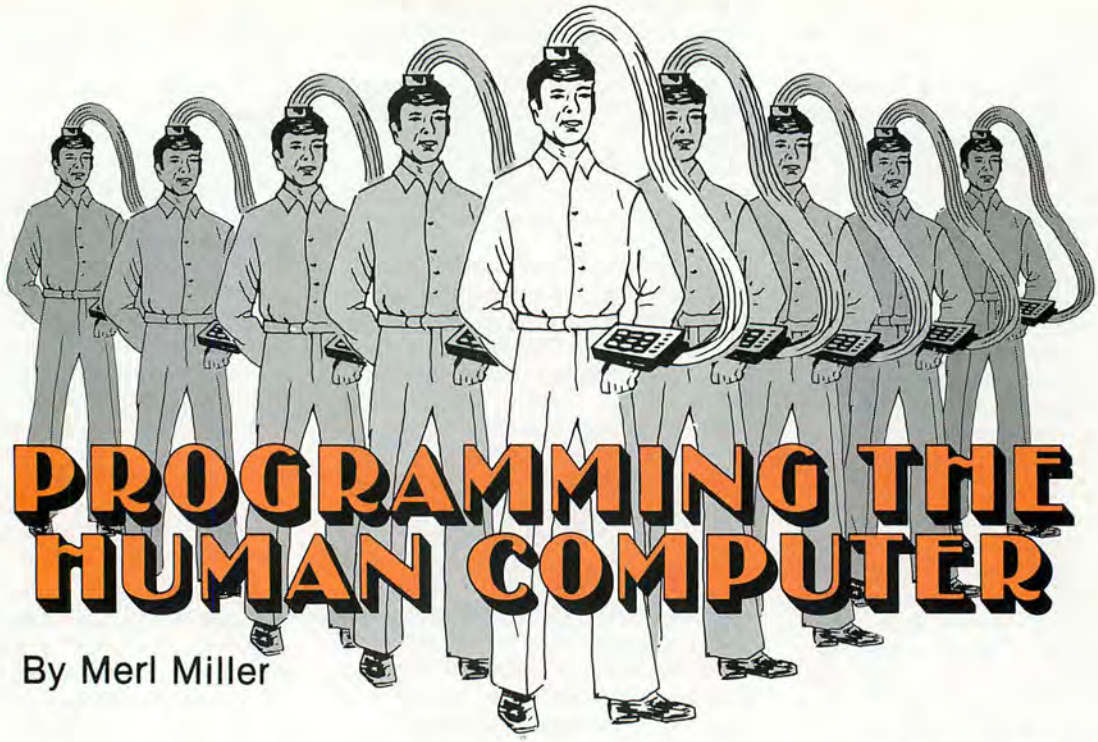
VENTURE CAPITAL COMPANIES: There are approximately one thousand venture capital companies in the United States. They are made up of companies which use exclusively private funds, or are financed with a combination of both private and public funds (Small Business Investment Companies, etc.). Venture capital firms will usually require a strictly equity position in a new firm; they usually reserve their debt investments for older, more stable firms. A source of information on venture capital firms is in Rubel, Guide to Venture Capital Sources (3rd ed. 1974). Each company has its own policy on conditions under which they will invest, but generally it can be said they will keep a close eye on the firm and its progress.

GOVERNMENT DEVELOPMENT PROGRAMS: Numerous government agencies have been set up to aid the small business. Probably the best known is the Small Business Administration, but there are also many state and local agencies which attempt to foster business development. Typically they can provide three resources to the small business. Many of them will loan money directly to the business if it meets certain qualifications. If it will not loan money it may be willing to guarantee a loan with a local bank. The final resource is technical information on a wide variety of subjects of interest to the small business.

All of these agencies have requirements which must be met in order for money to be lent or a loan guaranteed. While these agencies can be a source of capital for a firm, often considerable red tape is involved. Also, many firms in the formation stages have difficulty meeting eligibility requirements. Despite these problems, a thorough survey of government agencies makes sense for the small business in need of capital.

INSTITUTIONAL INVESTORS: Banks, commercial finance companies and other institutional investors are a major source of private financing. Capital from these sources usually comes in the form of direct loans, either to the business itself or to the owners in the form of loans which are then invested in the business. Usually all loans must be secured with personal or business assets. Again, each company has its own policy as to the amount of loans, duration, amount of collateral required. There are differences in companies so talk to a number of them.

All businesses need capital to one degree or another. By careful planning and negotiation it is possible to secure the capital your business needs without giving up too much control over your business. However, in order to accomplish this you must be aware of who your potential investors are and what they want in return for their money. With this information in hand you should be able to attract the capital you need, at terms consistent with your objectives.



PROGRAMMING THE HUMAN COMPUTER

By Merl Miller

HOW TO WRITE AN ARTICLE

How would you like to be rich and famous? Well, . . . would you settle for a slight increase in your income and a recognizable name among small computer enthusiasts? You can do it by writing articles for magazines like INTERFACE AGE. The pay is not great but it's worth the effort. I am going to give you a set of steps to follow that will help you research and develop your article. If you follow these steps, I can't guarantee you will be able to sell it, but I can guarantee you will get it written and some editor will review it.

Let's start with the basics. What should you write about? What do you know? You may be saying to yourself, "not much." Okay, but what were you just explaining to your friend in the computer club? Was it a chess program, a method of soldering without burning your fingers, a method of converting octal to binary, or . . . ? Any of these ideas can be turned into a useful and informative article.

Another good source of ideas are the magazines themselves. Pick out ten interesting articles and ask yourself the following questions about each one: Can I write an article like this? What did the author omit? What can be expanded? Can it be written at a higher technical level? A lower technical level? Can it be written from a different viewpoint?

Once you have your idea, you are ready to start writing. I follow these 12 steps:

1. *Make a list of topics and ideas.* Jot down everything that comes to mind. Don't worry about order.
2. *Write a rough outline.* Sort your topics and ideas into some kind of order.
3. *Write a good outline.* Now try to put your topics and ideas into a useable form. Pay particular attention to details. Throw out topics that don't apply and add new ones.
4. *Write a rough draft.* Before you start on your rough draft, do two things — read your outline carefully and put it away. Do not refer to your outline or your notes while you are writing the rough draft. Just let it flow. You will be surprised at how well it goes.
5. *Revise the rough draft.* Now you can refer to your outline and your notes. Carefully go through your draft adding comments, correcting grammar and spelling and deleting superfluous material. Edit and correct all technical material.
6. *Write a second draft.* Start with the first word of the first sentence and rewrite the entire article. You can refer to the rough draft when necessary.
7. *Do a line-by-line revision of the second draft.* Consider each sentence by itself. Can it be improved? How? Is the sentence really necessary? Does it lead logically into the next sentence?
8. *Write the final draft.* Do a total rewrite of the second draft and type it.
9. *Edit and revise the final draft.*
10. *Do a line-by-line revision of the final draft.*
11. *Retype and proof the final draft.* An effective way to proof is to read in "sentence reverse" order. Read the last sentence of the article first, the second to last sentence next, and so on.
12. *Retype (if necessary), insert photos, drawings and printouts and submit.*

This gives you the method, so let's turn our attention to the "how to." Most personal computing articles are of a "how to" nature. There are some fundamental rules to follow when writing this type of article. The most important are — your directions must be absolutely clear and they must work for anyone, anywhere. The following instructions may not be applicable to every situation, but it is a good idea to follow them whenever possible.

First Paragraph: Name your subject immediately and give your reader some reasons for wanting to read the article. Follow this with a list of reasons your reader will want to do it your way.

Second Paragraph: Make a list of everything he will need to complete the project, run the program, etc. If you are assuming some fundamental knowledge (for instance, programming ability in BASIC) provide some reference sources. If special equipment or tools are required give their approximate cost.

Third Paragraph and beyond: Start-

ing with the first step, explain all the procedures involved. Use the present tense and end on a high point. A good ending is as important as a good opening. Re-emphasize the highlights of your article.

There are a few mechanical requirements you should observe. First, your manuscript should be typed, double-spaced, on a good white bond paper. It should be at least three typewritten pages. Put your full name and address in the upper left corner of the first page and your last name, the title of the article, and page number in the upper left corner of succeeding pages. If part of your article contains copyrighted material, you *must* have permission of the copyright holder to use it. Your permission has to be for worldwide rights for the first printing and all reprints.

Line drawings and other "art" work present special problems for the magazine. Line work is generally redone, so it need not be in final form but it must be understandable. If you can't draw, supply a written description with the drawings. (Dear Magazine Artist, The funny looking box with the dots in it is a microcomputer, the wiggly lines are fingers.) Photographs should be included if at all possible. The best photo is, of course, an 8 x 10 glossy, but you can submit your own. Make sure everything is clear and in focus. A simple test is to hold the photo at arm's length and look at it carefully. This test works even better with computer printouts. If the printout can be read from a distance of a couple of feet, it will probably reproduce in the magazine. Printouts are reproduced from copy supplied, so be sure to send a good copy. Use a high quality white paper and a new ribbon.

Now then, are you ready to get started? Remember these things:

1. Find ideas wherever you can.
2. Follow the 12 steps of article writing.
3. Explain what you are doing and why.
4. Use a good opening and closing.

Next month, article writing, part 2. We'll talk about such things as research, reference sources, queries, etc. Thanks for reading this far.

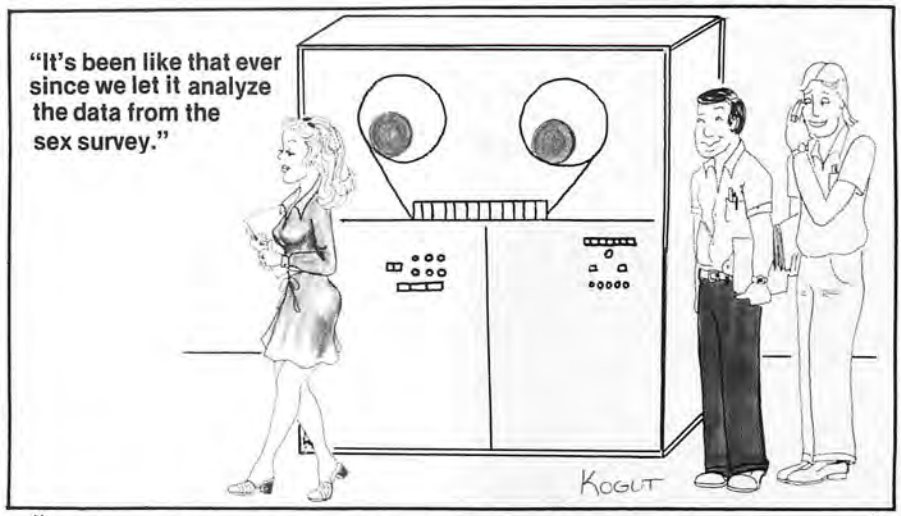
For your reference, here are the addresses of three publishers:

Hayden Book Co., Inc., 50 Essex St., Rochelle Park, NJ 07662, Attn: Editor, Computer Sciences

Prentice-Hall, Inc., Englewood Cliffs, NJ 07632, Attn: Paul Becker, Editor, Computer Sciences & Engineering

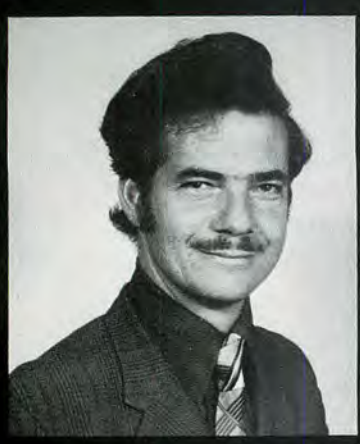
Tab Books, P.O. Box 40, Blue Ridge Summit, PA 17214, Attn: Charles Buffington.

—Editor



. . . FROM THE FOUNTAINHEAD

By Adam Osborne



The Heath Company has made its formal microcomputer kit announcements; and with a lot less fanfare, Radio Shack has also introduced a hobby computer — the TRS 80.

For those of you who might have been out of the country for the last two months, the Heath Company is going to sell 8080A and LSI-11-based microcomputer kits through their chain of Heath Kit stores. So far we have seen a small part of the eventual offering. Paper tape and cassette drive peripherals are already available but floppy discs are yet to come, along with floppy disc operating system software and applications programs.

Radio Shack has the TRS 80, a Z-80-based microcomputer system with which they have made a very low key entry into the microcomputer market. Rather than selling their microcomputer kits as just another product for the vast number of Radio Shack stores, a new company has been formed — Tandy Computers. (Radio Shack is a subsidiary of the Tandy Corporation). So far there is just one Tandy Computer store in Fort Worth, Texas; it is being run by Don French. Presumably if this one store does well the chain will expand.

You will be able to buy TRS 80 microcomputers in Radio Shack stores as well as in Tandy Computer stores. However there will be a difference in approach. In Tandy Computer stores you will find the TRS 80 along with other selected microcomputers and peripheral lines — much like any other microcomputer store. You will also find knowledgeable personnel and customer assistance available at Tandy Computer stores. Radio Shack stores, in contrast, will sell only Radio Shack products. Also Radio Shack stores themselves will fall into two categories. Approximately 100 Radio Shack stores (this is a very small number) will have TRS 80 microcomputers on display and will offer a limited amount of customer assistance. The vast majority of Radio Shack stores will have no microcomputers on display and will offer no assistance to customers. At these stores you can buy out of the Radio Shack catalog and that is it.

I suspect that a great deal of unevenness will develop among Radio Shack stores with regards to their handling of microcomputer products. I recently received a letter from Mr. E.C. Perry who runs Radio Shack store #7082 in Palm Springs, California. Mr. Perry wrote me a very enthusiastic and well-informed letter which indicates that his store plans on doing much more than peddling merchandise out of a catalog.

Tandy made a wise decision not to sell microcomputer systems through all Radio Shack outlets. The thousands of Radio Shack outlets are geared to selling low cost consumer electronics using an unsophisticated sales force, the vast majority of whom probably know nothing about computers. Had Radio Shack tried to sell microcomputer systems the way it sells digital clocks and transistors, six months of mismerchandising would have given the whole operation such a sour public image that Tandy would have looked back on microcomputers as a bad dream. By doing only as much as they can do, and by doing it well, the project stands a good chance of success.

There are far fewer Heath Kit stores than there are Radio Shack outlets; in fact there are only about 50 Heath Kit stores in the entire country. Nevertheless store personnel training is one of the most serious problems that the Heath Company has had to face.

In all of this there is a perverse message of hope for the existing computer stores. An existing store owner's first reaction may be dismay at the thought of having to compete with Heath Kit and Radio Shack. But look at the gamble these companies have taken selling unique products through company stores. Radio Shack is at the present time in the position of a computer store chain which has invested all the money it takes to set up another IMSAI or Processor Technology — simply to have a product for sale. It may cost anywhere from one to five million dollars to develop the hardware and software of one complete microcomputer system. That is a great deal of money, money which Heath and Radio Shack have to find, but the average computer retail outlet does not have to worry about: that is a quantity of money which must be recouped as profits in a very short space of time. And there is the key to the whole problem; the Heath Company and Tandy Computers must recoup their development expenses very quickly because the microcomputer market is one that will not stand still.

The 8080A is already on the verge of becoming an obsolete microprocessor and by this time next year the 8080A may be completely obsolete. Even the Z-80 will have a relatively short life. In October Intel will probably announce the 8086, their new 16-bit microprocessor. Shortly thereafter Zilog will announce the Z-800, their 16-bit microprocessor. Both Intel and Zilog 16-bit microprocessors will probably be available, in quantity, by mid 1978. But we do not have

to look for new announcements to see the advent of the 16-bit microprocessor; Texas Instruments is finally stirring themselves to support the TMS 9900 and Fairchild is now shipping the 9440 — a Nova 1200 Central Processing Unit on a single chip. These 16-bit microprocessors are particularly interesting to people who plan to write and execute many programs — and that is exactly what most microcomputer store customers are doing. The LSI-11 Heath Kit is the only Heath likely to remain competitive for any length of time.

Now the scenario of rapid obsolescence is very frightening to manufacturers, but it is likely to be the salvation of the independent computer store. A company such as Tandy or Heath will probably get out of the microcomputer business if they introduce one or two systems too late to recoup their losses. After all, what guarantee do they have they they will not make the same mistake again — in spades? Now this is a nightmare that visits all hardware manufacturers, but it is of no concern to the independent computer store. After all, if one microcomputer manufacturer goes out of business it will be because another manufacturer introduced a better product. The independent computer store owner is in the position of Nero fiddling while Rome burns. They can watch from the sidelines and remain totally unaffected. And if Tandy Computers end up as just another microcomputer store chain, they will have no significant advantage over existing computer stores.

Meanwhile in order to compete most effectively the independent computer store must compete where the mass merchandisers are weakest — offering total systems to end users. A total system includes an entire microcomputer, together with programs and documentation. Programs and documentation invariably will have to be customized. But remember, the job of customizing software and preparing documentation should be left to independent consultants. Computer stores should stick to selling products not services. A consultant must take responsibility for the time he spends on a job. If a computer store hires a programmer by the hour then has to bid a fixed price for the programmer's services, the store is stuck with every overrun; and believe me, programming jobs overrun every time. The solution is for each store to have available a small number of reliable consultants that they can recommend. This is easy enough for individual stores to do but it is a very difficult task for large corporations with many outlets.

Perhaps it is time for computer stores to start retailing entire business systems. Promedics, 560 San Antonio Road, Suite 201A, Palo Alto, California 94306, has the type of system I am thinking of. It is an Altair-based system that does bookkeeping for doctors, lawyers and similar professional offices. Providing there is enough margin in handling this kind of system, it is business that could be very profitable for computer stores and manufacturers alike, since the stores could create the volume which the manufacturer needs. Customers would also be happier with a local resource for program changes and hardware service. In fact, hardware service all on its own may be sufficient reason for small companies to rely upon computer stores as their principal outlets. A computer store can do profitable business servicing systems within driving range of their store. A manufacturer will quickly go bankrupt trying to fly service technicians all over the country.

For the software consultant who cannot afford to buy every type of microcomputer system that needs programs, operations such as Ulinar Corporation, also known as the

Branched to Page 22

SENSE LINE

Bob Jones

Let's talk about group purchase programs in club environments. Now it doesn't take a genius to recognize the benefits of large volume price discounts and the advantages of buying power leverage, but when so many must be involved can there truly be a real savings? What kind of question is this? Of course there are savings—just because someone in the club must administrate the program almost on a 4-6 hour a day basis, buy shipping labels and packaging materials for those who can't make it into the monthly meetings, run to the post office, run his own telephone expense right through the ceiling, worry about the accounting of dollars and in which direction they went, returning defective merchandise for the club member, keeping track of more credits and debits, and last but not least, where did the guy go who cashed the last purchase check and didn't deliver, leaving everyone on the hook?

Now, what happens to the club group purchase volunteer? His telephone is ringing off the hook because of delayed deliveries, wrong merchandise received, defective merchandise to be returned and more favors requested.

Do you know that that club group purchase volunteer has to be one heck of a swell guy to take all those problems, provide all of the information and service and go through all of the pain of running a going business for free? You might thank his wife or girl friend because no doubt she is doing a lot to help him, too.

Now back to the question, does anyone really save. In the long run you can realize a legitimate *net* savings of 7-10% depending on the type and quantity of merchandise ordered.

Do not include the action surplus parts buys as they are a shot in the dark risk, or the "special deal" items which are to never be sold again at that "low" price. Some companies find club group purchases are a good dumping ground for marginal parts. It's OK if you know you are going to get what you pay for. In my discussions with some of the club group purchase workers, many buy from the *established* computer retailers, or the authorized component distributors such as the Hamilton-Avnets, Schwebers, Cramer's, etc. for components. The most important factor in dealing with established firms is that most will have off-the-shelf stock and a return policy for proven defective material.

OK, so some say, why leave out dealing with the manufacturer. Depending on the manufacturer and his product, there can be some advantages and disadvantages. The product line will pretty well dictate the outcome. If it's a systems-oriented manufacturer, generally you will find that he wants to deal in OEM quantities to one buyer/user *only*. He doesn't want to field the problems from a varied group of computer hobbyists.

However, if he is totally oriented in the hobby computer field then it will be certainly a good deal for both. But now a word of caution. Unfortunately, a new manufacturer in the hobbyist field may not have found out how much it costs to exist in this fast moving environment and, coupled with potential production problems, may not be the best target for a group purchase. Several bitter lessons have been learned recently.

Generally a new manufacturer is best served by lots of single more profitable orders than grappling in the price war dirt trying to satisfy a low-cost demand. He could be forced into spending your entire purchase dollar trying to produce something that may not be produceable at that price.

There are several surplus parts dealers who test their components and cards and guarantee them. However, group purchases don't provide much savings as the competitive nature of that field keeps the prices significantly low individually.

If you didn't realize the problems before, you can appreciate them and your group purchase worker now.

The question now remains, is the 7-10% savings worth the hassles?

If you have any comments on this or any other subject, I would like to see them. *Send them to Sense Line,* INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701.

FOUNTAINHEAD

Vectored from Page 21

Marin Computer Center, may provide the solution. David Fox (phone (415) 388-1294 or (415) 472-2650) has started Ulinar Corporation in San Rafael, California, with very different initial goals. Ulinar Corporation is a non-profit education organization which will make microcomputers available to the general public, and in particular to local school districts; but it will also be available to individual software consultants who should not overlook such resources.

For the computer hobbyists with more enthusiasm than budget, the "BOPA," being marketed by Vamp, Inc., P.O. Box 29315, Los Angeles, CA 90029, may be just the answer. Assuming that your system is too small to run an editor or assembler, the "BOPA" gives you boards, with strips of plastic on which you write individual assembly language instructions. By moving strips around as you change your program, you can eliminate many of the addressing errors that are an inescapable part of all hand assemblies.

CALL FOR ARTICLES

We are actively seeking articles in hardware, software and general applications of microcomputers in industrial, business, science, medicine and personal fields.

Articles authored by individuals during leisure time are remunerated at a rate from $15.00 to $50.00 per published page and articles describing company projects carry author and company byline, but no honorarium is offered. Articles accepted will be acknowledged with a binder check within thirty days of receipt.

Manuscripts should be double-spaced, typewritten pages, one inch margins, and not less than 3½ pages in length (one published page). Pages should be numbered to insure correct text. Photographs should be numbered and labeled on the backside with a description. Tables, listings, etc., shall be on separate sheets. Photos should be taken with uniform lighting and background, in the form of glossy black and white prints. Computer listings shall be printed using a new ribbon to assure darkest print copy. Authors shall supply a statement of their background, expertise and level of accomplishment.

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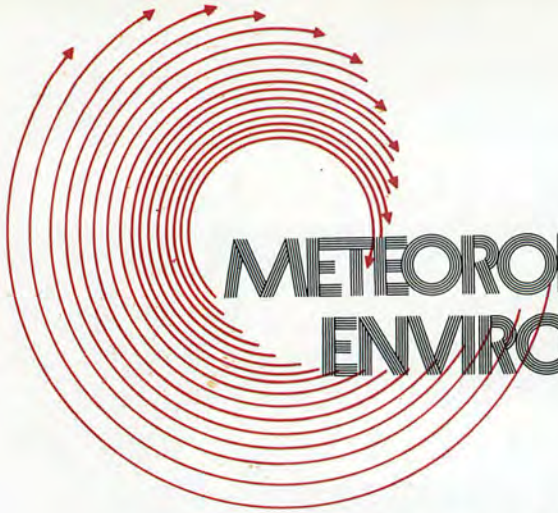


METEOROLOGY / ENVIRONMENT SPECIAL

Editorial

Computers for Survival

by Dr. John W. Mauchly

Through many long ages, most forms of life have survived environmental changes through adaptation. Now Man has the technology to change his environment, and he may do this recklessly, before he even suspects what the consequences may be. Furthermore, the changes he makes may be faster than natural adaptation can follow. We who have brought this about must now adapt in a new way: we must learn to use our technology of computers for survival.

With hundreds of thousands of people now in possession of more computing power than Kepler or Newton ever imagined possible, we may find some fraction of our population becoming not only computer literate, but simulation literate. Some will not only understand the concerns of the Club of Rome as to limits to growth, but will themselves explore what computer simulation and modelling can do in charting possible means for survival.

But there are many people who have as yet no faith in computer predictions. This is understandable. We are besieged every day with all kinds of predictions, many attributed to the computer, as if that guaranteed the result. Yet these sacred messages are often as contradictory as the "facts" purveyed by supposedly well-informed politicians.

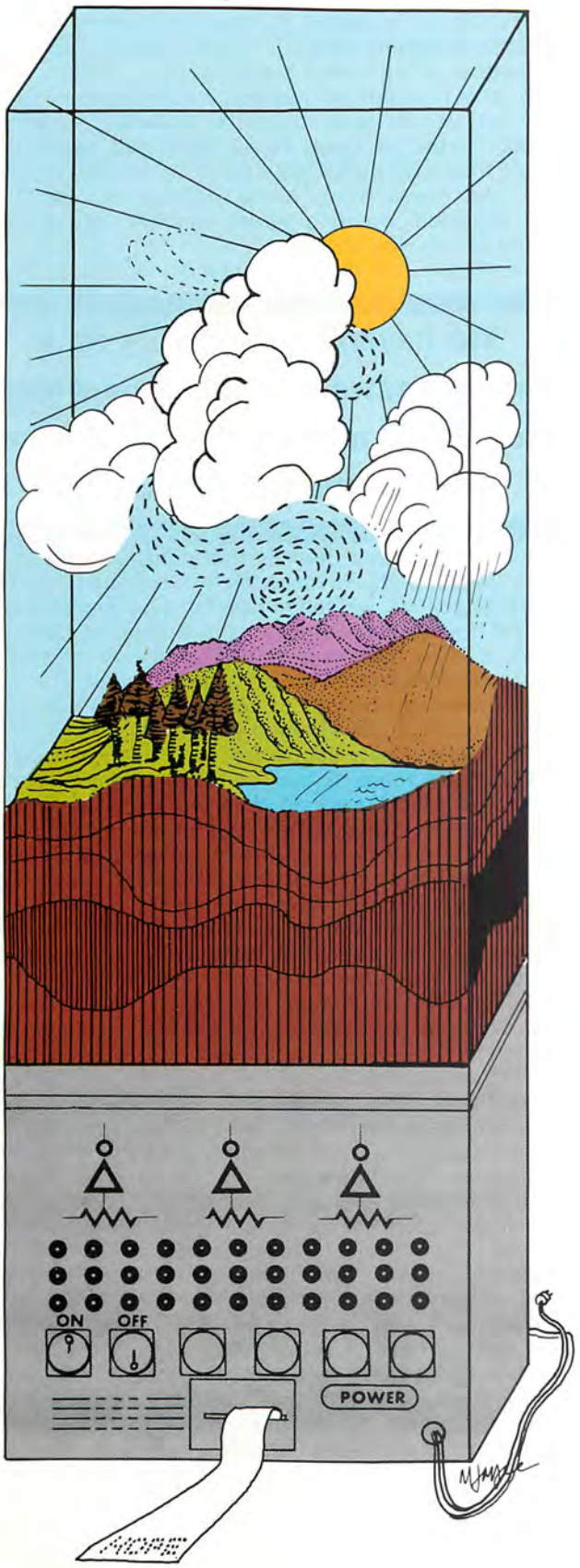
Our new throng of computer users cannot escape learning how dependent the computer is on guidance and input. However, with all its speed and reliability, it is a tool beyond compare to enable us to survive, if we but give it the data and the program.

We have another tool — a methodological one. We should, I believe, seek our answers through scientific method. That tells us to put no trust in oracles and seers, no matter how famous. It also says to be wary of those who, although working in the field of science, give "categorical" offhand reasons why some new idea should not be tried. The most precious thing in science is the new hypothesis — a new question to test.

It may seem quite sensible to screen out projects that might waste large amounts of resources and have little chance of success, but one should be very careful who does that screening. It may take only a small effort for a very important re-evaluation.

In 1935, when I was teaching college physics, I had no patience with categorical assertions that the Sun or any other extraterrestrial body could not affect our weather. It seemed to me that newly developed statistical methods might be just the tool needed to make better tests of some hypotheses in the solar-weather field. In the course of making a few tests, I found I needed one more tool — a fast and versatile computer.

Only the Ursinus College students of 40 years ago recall the late hours I spent in the laboratory trying to modify cosmic ray scaling circuits into some device I



Features in This Section

could afford to build for my self-financed weather research. But a war changed all that. At the University of Pennsylvania the Army "bought" my ideas for an electronic digital computer, and Eckert and I built the ENIAC — the first large general purpose high-speed calculator. Since the Army owned it, I had no chance to try my weather problems on it.

Instead, Eckert and I solved another computer problem, the problem of making much cheaper storage devices, so we could build the UNIVAC System with 12000 "bytes" at ready recall. With that capacity, we could then have frequently-used program instructions in the "high speed store," along with current data. This is the so-called stored program concept, wrongly attributed to von Neumann.

For larger programs and much more data, Eckert-

We haven't gotten very far in finding answers to the solar-weather problem. It may be that we have not posed the right question.

Mauchly developed the very first digital magnetic tape input-output units. To make the tape hold up under rapid starts and stops, we had to develop a metal-plated form.

The first of these went to the Bureau of Census in 1951, and in the years following scores of UNIVAC Systems were sold to an expanding market. The world has now bought billions of dollars worth of EDP equipment. How has this affected weather research?

Of course, very sophisticated computer runs are made many times a day as a basis for short-term forecasts. Much research time has been spent in the last 20 years to find better ways of doing that. But we haven't gotten very far on the "solar-weather" problem. It may be that we have not posed the right question.

Computers have done something indirectly for weather research — they have made possible the space probes and weather satellites from which we receive tremendous amounts of data. By means that I had not foreseen, meteorologists are being led to wonder whether solar variations might not hold some answers for them.

With a personal computer, I can get answers to problems that others may not think worth posing. And that may help us to survive. For many others who now have access to computing power such as Kepler and Newton never had, I would suggest that they try working with models of food, energy resources, and other variables which will be critical for our survival. Are we, as studies for the Club of Rome have suggested, already into difficulties such that "everything will be worse before we can possibly make it better?"

Eventually, that popular game of survival, "Star Trek," will lose its hold on many of us, and the challenge of something closer to reality might grip us. There seems to be no reason at this time, with all the personal computing going on, that thousands of people can't begin practicing on simulation of global problems.

If we can get Congress to play "Star Trek," then we are a step ahead. Later, as that game palls, introduce our lawmakers and officials to some of the more realistic simulations, involving real food, real energy and real population. By some avenue of computer games, perhaps we can get both the voters and those who govern to accept the computer as more vital than last month's industrial production reports when dealing with problems of survival.

The Dumb Terminal lets you put it all together.

With the new, lower-priced Dumb Terminal™ Kit, that is. Pick one up and escape, once and for all, the headaches of scavenged teletypes and jury-rigged TV sets. With just a little time and aptitude, you can have a live and working Dumb Terminal right in your own home, garage, or business. One that lets you get it all out of your system —or into it.

Forget the cheap imitations, with their overblown price tags and interminable lists of options. With the Kit, you can build yourself the same, old basic Dumb Terminal that's been selling over 1500 units a month. With basic, sensible features like a bright 12" diagonal screen. Fifty-nine data entry keys. 1920 characters displayed in 24 rows of 80 letters. Plus 33 positive action switches that let you activate functions like 1 of 11 different baud rates, an RS232C interface, or a 20mA current-loop. And more. Not bad for Dumb

All you need, besides the Kit, is some initiative, and a few basic tools—a good soldering iron, wire cutters, needle-nose pliers, and one or two trusty screwdrivers. The Dumb Terminal Kit provides you with everything else. Including an attractive cabinet, CRT screen, keyboard, PC board, and all essential electronic components. Naturally, you also get illustrated, step-by-step assembly instructions, not to mention an easy-to-understand operator's manual.

So, if you'd like more input on the Dumb Terminal Kit, just fill out the coupon and we'll send you complete, free information.

Oh, and by the way, just by sending in the coupon, you will be made a charter member of the Dumb Terminal Fan Club. A select organization that will send you your own nifty Dumb Terminal Fan Club Kit, containing: an official certificate of membership; an autographed photo of the Dumb Terminal himself; and a bona fide membership card to prove irrefutably you're "One of Us." (Sorry, limit one kit per person.)

And, if you include a trifling $6.00, you can have your very own Dumb Terminal T-shirt. (No limit at all on these.)

Simply mail the coupon and get the whole assortment. And find out why members of the Dumb Terminal Fan Club are some of the smartest people around.

ISi®

Dumb Terminal. Fun Club.

Yes, I would like more information about the incredible Dumb Terminal Kit. And don't forget to enroll me as a Charter Member in the Dumb Terminal Fan Club.

Name_____ Title(?)_____

Company_____

Street_____

City_____ State_____ Zip_____

Enclosed is $_____ for an official Dumb Terminal T-shirt(s).

Please make all checks and money orders payable to LeAnce & Reiser, OK?

Quantity and size(s) of shirt(s) required: ____S ____M ____L ____XL

Rush this application to: Dumb Terminal Fan Club Headquarters c/o LeAnce & Reiser, P.O. Box 17123, Irvine, CA 92714.

METEOROLOGY / ENVIRONMENT SPECIAL

COMPUTERS THAT TALK

By Linda Folkard-Stengel, Associate Editor

Meteorology is derived from a Greek term meaning the study of phenomena in the sky. It is a very old discipline. The search to understand and to attempt control of climate is ancient. Sages of the past compiled impressive amount of usable information, and an equal amount of misinformation which still persists to this day. The common people of the past were often those most dependent upon weather for survival. They developed songs and jingles as mnemonic aids to assist in short-range weather prediction.

Although pre-technological societies did possess some modicum of predictive capability based on observations of repeatable event chains, the causes of these effects had to await the discoveries of geophysical laws governing our planet. Even then observation was hampered by the lack of long-distance communications common to this century.

The fundamentals of modern weather analysis are based on seven known equations and seven unknowns dealing with laws of gas behaviors, Coriolis force and thermodynamics. Prior to the computer era, integrating such a mass of data daily was a task beyond economic feasibility and yet weather prediction is an economically sound investment. For this reason the computer was applied to this task very early in its lifetime. Now computerized weather prediction has spawned a vast network of installations encompassing the entire globe.

In the United States the "heart" of the meteorology computer network is an IBM 360/195 located in Suitland, MD. This installation interfaces with a network of dedicated minicomputers located on land, sea, air and orbit, and together their data output produces fairly reliable 12-, 24-, 36-, 48-, 72-, 84- and 96-hour forecasts.

The most spectacular spin-off of the Space program has been in this field. In addition to the traditional land-and-sea-based stations, orbiting weather satellites now regularly give us a space-eye view of our planet's atmospheric dynamics. Named GOES 1 and 2, (*G*eophysical *O*rbiting *E*arth *S*atellite), the satellites hang in synchronous orbits above the equator, one over the Amazon and the other over the 150th Meridian. Their payload includes a microprocessor, IR and standard scanning

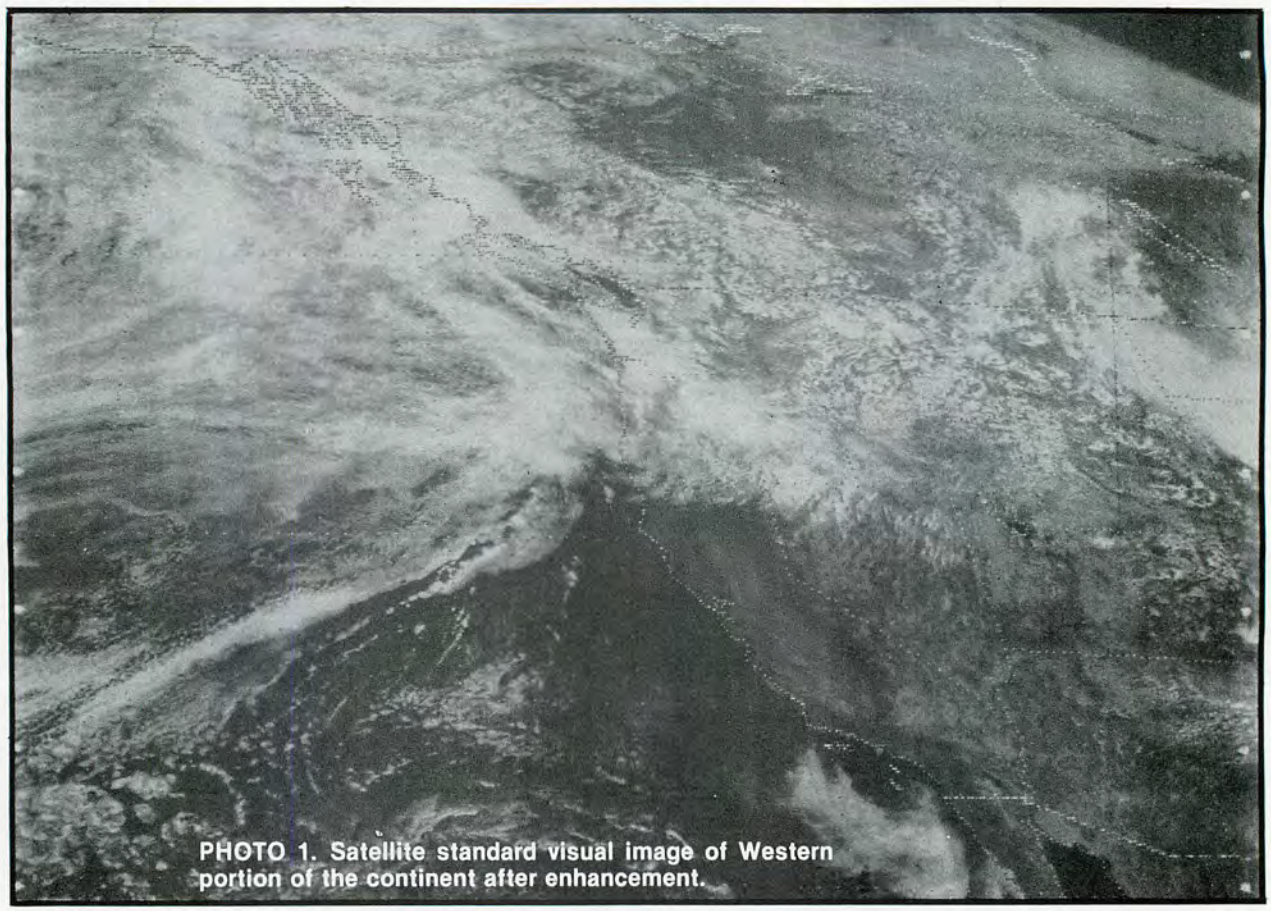


PHOTO 1. Satellite standard visual image of Western portion of the continent after enhancement.

ABOUT THE WEATHER —

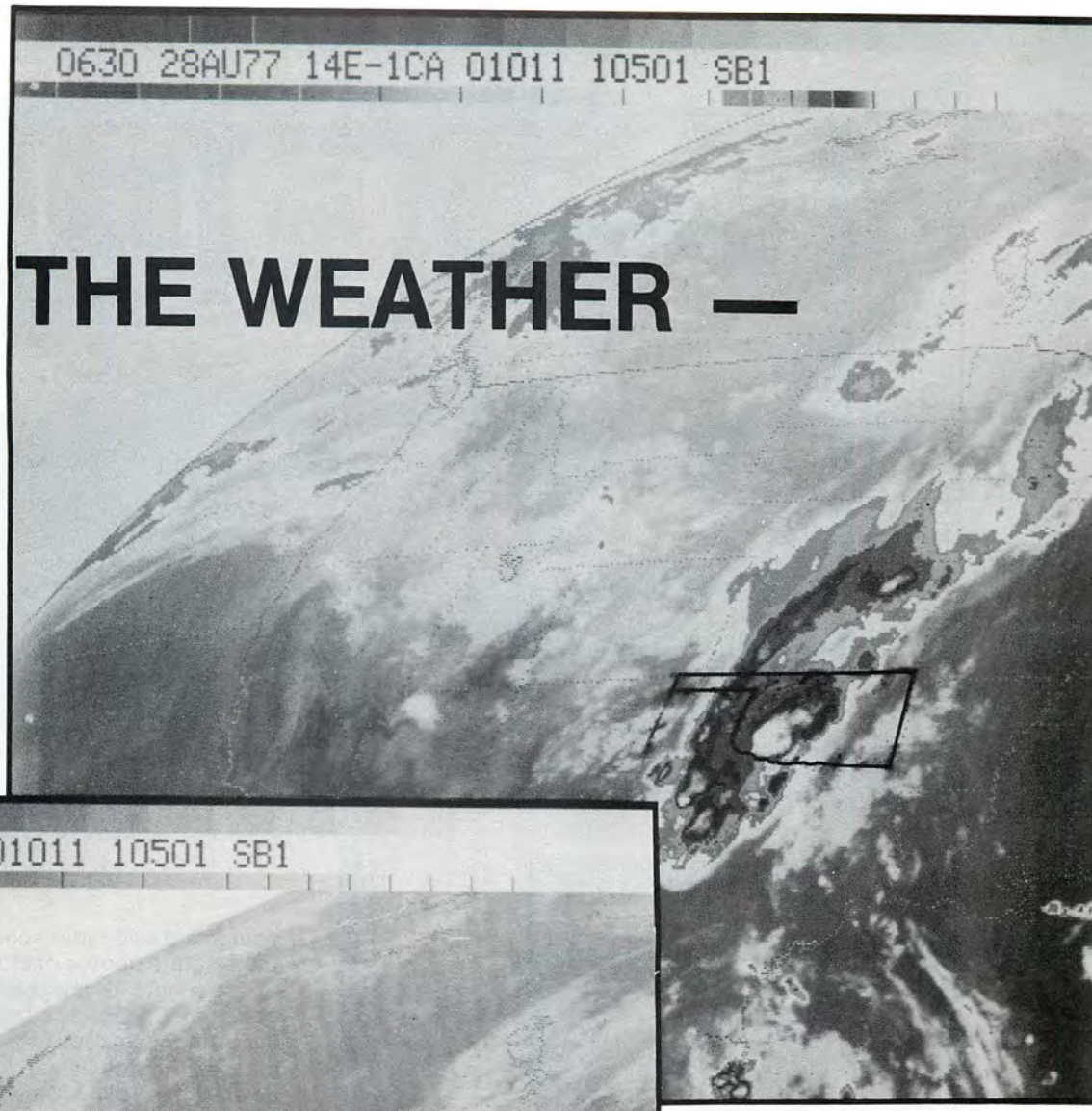


PHOTO 2a. Infra-red image taken at night. White spot represents cold mass estimated at −30 to −50° Celsius. This is a possible extremely large thunderstorm which peaks up to 17,000 meters.

PHOTO 2b. Same cold mass after computer enhancement delineating warmer and colder areas.

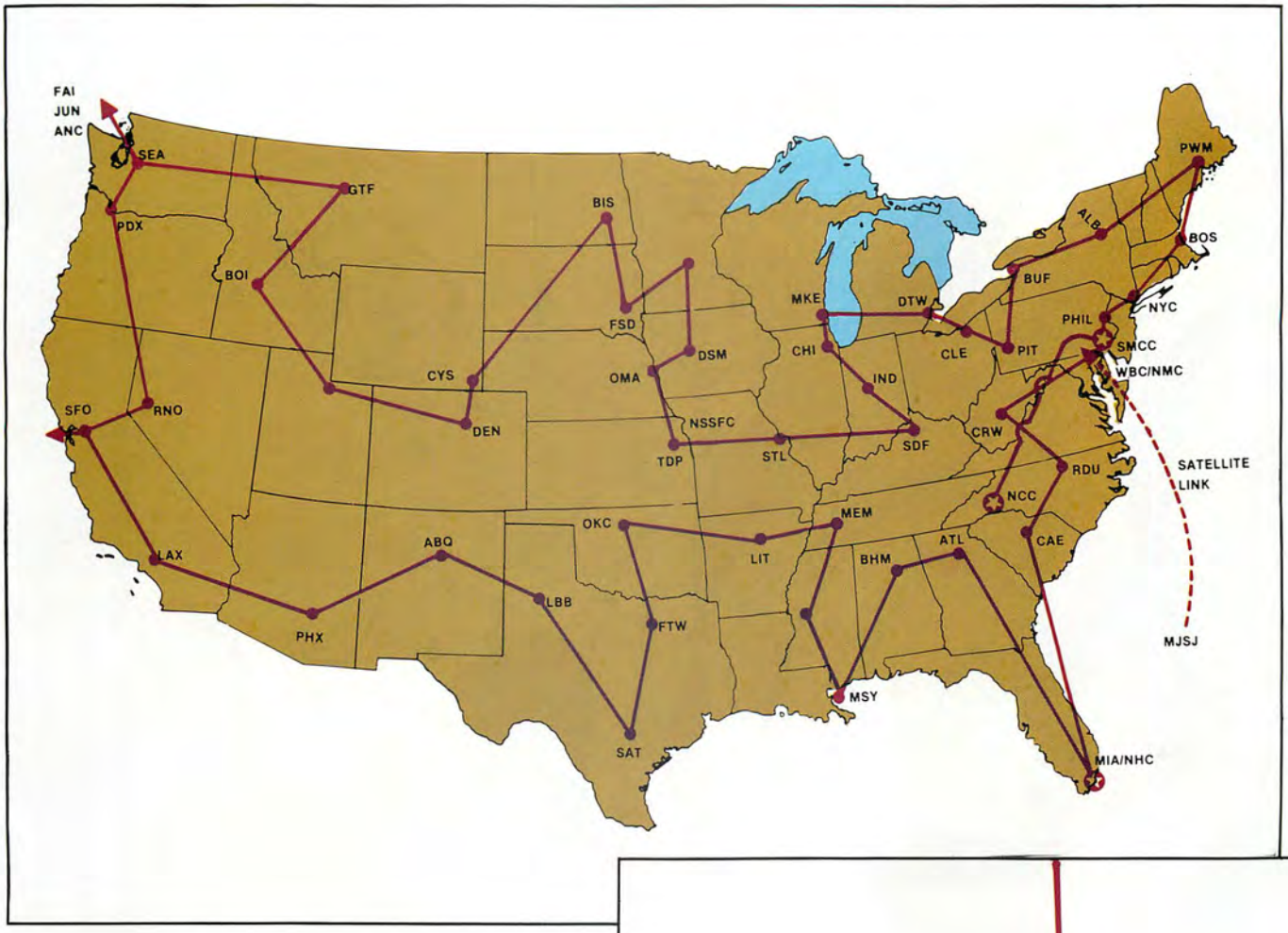
PHOTO 3. Forecaster's console. The CRT displays replace the stacks of paperwork previously required. Filing of information will be on disc.

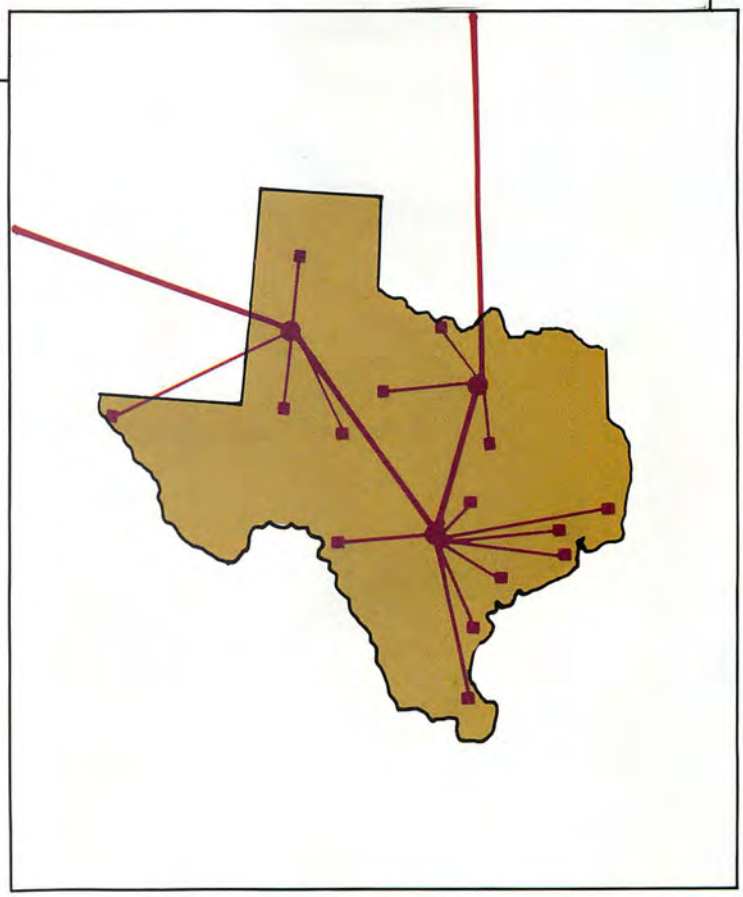
PHOTO 5. Closeup of console.

equipment and radio sonds. We are now all familiar with the satellite photos of cloud masses photographed from Space (Photo 1), but this is only part of the information obtained. The infra-red sensors function day and night, detecting temperature variations within the cloud masses (Photos 2a and 2b). This information is beamed down to the NOAA Data Acquisition station in Wallop's Island, VA. There the full-disc images are enhanced, then uplinked to the satellites for re-transmission to Suitland, MD where they are sectorized and the desired sectors are sent by microwave link to the network of weather stations. In the course of the enhancement, the image is etched with dotted outlines of the continent, the state boundaries and meridial co-ordinates. The whole process takes about eighteen minutes and two pictures are transmitted every hour to field stations.

The National Weather Service stations on the network (Figure 1) use this information together with much other data in the computer to forecast temperature highs and lows, rain probability, wind velocity and barometric pressures usually for a 24-hour period. Quick sketches are drawn over computer printouts to indicate warm and cold air masses. A sample of this hand-drawn plot from the Weather Service Forecasting Office in Los Angeles for Saturday, August 13, 1977 is shown in Figure 2.

At the present time much of the information is still transmitted by facsimile and teletype and a little plotting is done by hand on paper. By 1980 the Weather Service will have its Automation of Field Operations and Services (AFOS) program fully operational. The AFOS program is designed to replace manual, semi-automatic equipment and paperwork operations. Through electronic data handling and graphic displays meterorologists at local weather stations will be able to eliminate the time-consuming processes of handling and filing messages and maps presently received on teletype and





The National Distribution Circuit: Computers Talking to Computers

- National Digital Circuit
- National Centers
- Weather Service Forecast Offices
- Weather Service Offices

Figure 1. Map of AFOS network showing forecast offices and service offices with sea and orbit links.

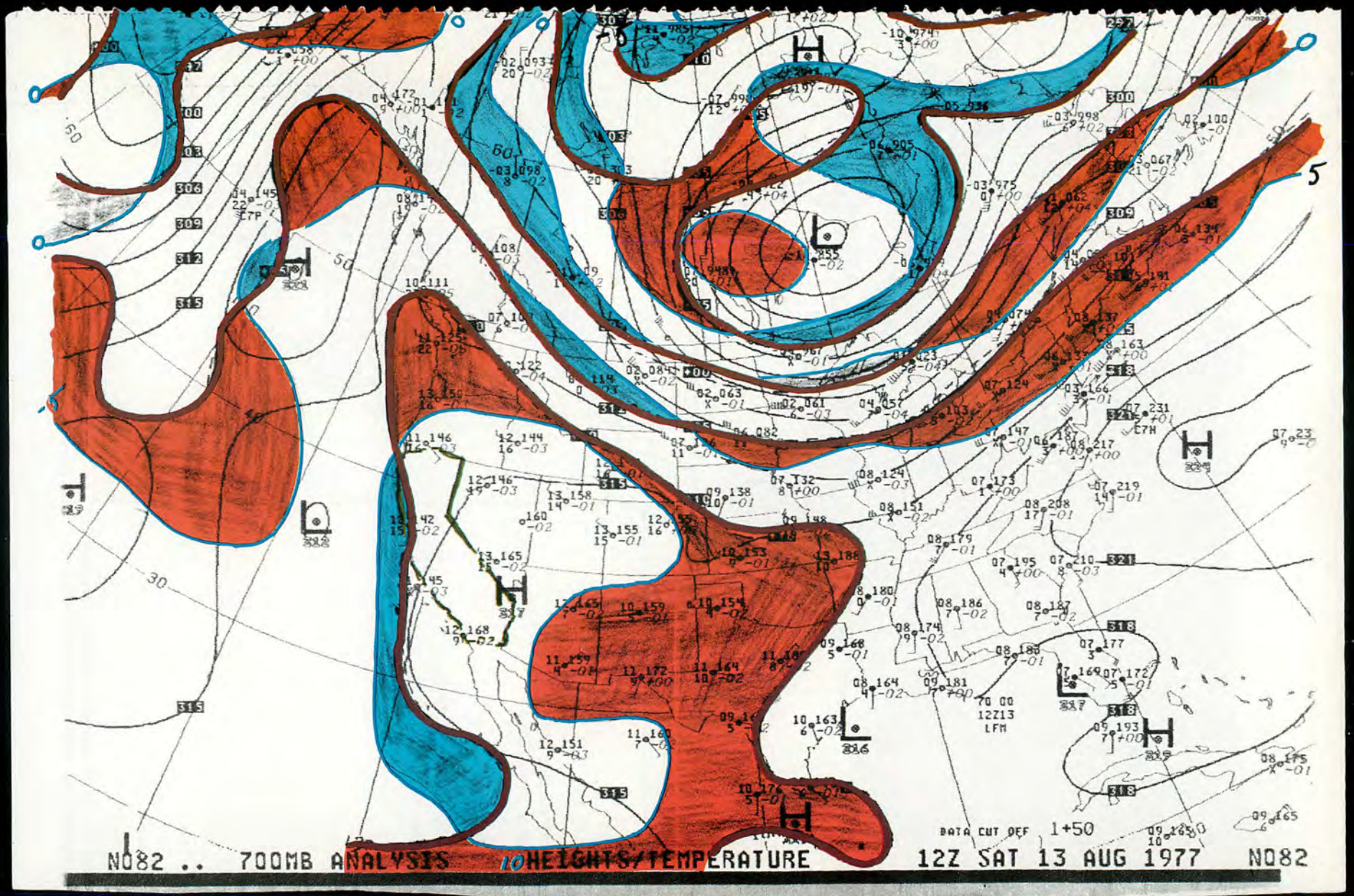


Photo of actual computer printout showing hand-drawn plots indicating warm and cold air masses for August 13, 1977

facsimile machines. Data arrival at the station will jump from the present 100 words per minute to 3,000.

Some of the system is already operational, but spotty. When completed each station will be equipped with a Data General S 230 Eclipse minicomputer installation. Core memories up to 128K depending upon station requirement will be provided. The CRT displays will have zoom capability and will eliminate the need for plotting on paper. However, a printer-plotter will be available at each installation to generate hard copy when required. (See Photos 3, 4 and 5).

The minicomputers with their relatively low operating costs will enable the system to run continuously and they will interface with each other on a loop basis. For example should bad weather develop in Los Angeles, the information would be simultaneously transmitted to San Francisco and Phoenix, relayed from those two points to the next station on the north and south routes of the loop, Albuquerque and Reno and onwards until the data meet at the satellite link for uplink transmission (Follow the route on Figure 1).

Hurricanes, tornadoes, blizzards and other thunderous growls of Mother Nature can be studied, predicted and followed more efficiently with this method and earlier warnings to the populace can affect savings in life and property.

Another function of the Weather Service is fire weather forecasting and plotting. In the Los Angeles Forecast office, meteorologists like Brian W. Finke maintain daily shift vigil on fire weather conditions. A special FORTRAN program called AFFIRMS, of which Figures 3a, 3b and 3c are printouts for California of the August 30/77 update, is part of a special AFFIRMS network (*A*utomated *F*orest-*F*ire *I*nformation *R*etrieval *M*anagement *S*ystem). This is a national timeshare system. It serves two purposes: to alert forestry officials and the public in general of imminent high-combustibility conditions and when fires have broken out to assist in plotting their course, conditions and threatening humidity changes. This information is transmitted directly to the firelines. Again speed of information delivery can result in substantial savings in property, and more important, in prevention of crews getting trapped in pockets by sudden changes of winds.

Accomplishments of technological meteorology are already spectacular, but what about the future? Will we be able to control climate by the end of the Century? There are two schools of thought; a few of the optimists say yes, and the conservatives reserve opinions. Conservatives see the technology in this field as having passed the half-line mark on the asymptotic curve. Some feel that long-range weather forecasting and control may not ever be feasible. However, no expert believes that nothing remains to be done in the field of meteorology.

Figure 3a. Printout from AFFIRMS timeshare network.

```
HHHHHHH
U=MM_AN68551,*LAX,


NFDR AFFIRMS (PSH:124/65/ 4/ 3)

FOR AID, ENTER: HELP
[[[[[[[[[

COMMAND?SET DAYS 1


COMMAND?FILE READ ZD551


FIL02I NOW EXECUTING FILE *ZD551

FIRE WEATHER ZONE 501

------------------08/30/77------OBS--------18:48GMT------------------>
STATION DY HR W DBT DPT  RH YL ML DIR WS 10H TMX TMN HMX HMN PD PPTAMT

GIBRAL 29 14 0  81  65  58  1  1 SW   3   7  84  66   0   0  0  0.

FIRE WEATHER ZONE 502

POZO   29 14 0  98  55  24  1  1 NE   9   5 100  60   0   0  0  0.
FIGROA 29 14 0  93  48  22  1  1 NW  11   4  95  74   0   0  0  0.
PRIETO 29 14 0 103  56  21  1  1 SW   6   3 104  65   0   0  0  0.
ROSVLY 29 14 0  92  44  19  1  1 SW  10   5  97  49   0   0  0  0.

MEAN:          97      22              9   4  99  62   0   0  0

FIRE WEATHER ZONE 503

BRANCH 29 14 0  90  46  22  1  1 NW  10   7  94  66   0   0  0  0.
CHUCHU 29 14 0  85  41  21  1  1 NW   9   4  90  48   0   0  0  0.
OZENA  29 14 0  90  -6   2  1  1 W   16   5  90  40   0   0  0  0.

MEAN:          88      15              12  5  91  51   0   0  0

FIRE WEATHER ZONE 504

CACITA 29 14 0  88  61  41  1  1 N    4   7  88  58   0   0  0  0.

FIRE WEATHER ZONE 505

TEMESC 29 14 0  95  57  28  1  1 SE  15   6  98  63   0   0  0  0.
CHATSW 29 13 0  98  67  36  1  1 NW   7   7 100  60 100  35  0  0.
LECHUS 29 13 0  88  68  52  1  1 SE   4   5  90  58 100  45  0  0.
NEWHAL 29 13 0  96  62  33  1  1 SE  15   7 102  60 100  27  0  0.

MEAN:          94      37              10  6  98  60 100  36  0

FIRE WEATHER ZONE 506

CLRCRK 29 13 0  90  46  22  1  1 W    7   5  92  65  48  22  0  0.
PELONA 29 13 0  88  49  26  1  1 SW  24   4  88  70  46  25  0  0.
VINCNT 29 13 0  95  44  17  1  1 NE   8   3  96  65  92  17  0  0.
WRMSPR 29 13 0  93  47  21  1  1 S   15   4  94  74  37  19  0  0.

MEAN:          92      22              14  4  93  69  56  21  0

FIRE WEATHER ZONE 507

VETTER 29 13 0  85  36  17  1  1 S   18   5  85  68  30  16  0  0.

FIRE WEATHER ZONE 509
DUARTE 29 13 0  89  68  50  1  1 SW   7   7  89  58 100  45  0  0.
LTLTEE 29 13 0  90  67  47  1  1 SW  10   8  90  54 100  34  0  0.
PADUA  29 13 0  90  64  42  1  1 SW  14   8  90  64 100  39  0  0.
TANRPK 29 13 0  96  46  18  1  1 S    7   4 100  54  74  17  0  0.
TEMESC 29 13 0  92  61  35  1  1 N    8   4  96  58 100  35  0  0.
TENAJA 29 13 0  94  50  22  1  1 W   10   2  96  59  75  22  0  0.
RAMONA 29 13 0  87  65  49  1  1 W   12   8  90  58 100  45  0  0.

MEAN:          91      38              10  6  93  58  93  34  0

FIRE WEATHER ZONE 510

LYTLCK 29 14 0  98  47  18  1  1 SE   6   3 100  64   0   0  0  0.
MILLCK 29 14 0  93  51  24  1  1 SW   7   6  93  60   0   0  0  0.
DEVORE 29 14 0  97  59  28  1  1 SW  12   4  97  68   0   0  0  0.
RAMING 29 14 0  92  58  32  1  1 W   14   5  97  66   0   0  0  0.

MEAN:          95      26              10  5  97  65   0   0  0

FIRE WEATHER ZONE 511

BGBEAR 29 14 0  80  45  29  1  1 NE  12   4  82  40   0   0  0  0.
PINFLT 29 14 0  78  39  25  1  1 NE  13   5  80  46   0   0  0  0.
CONVPS 29 14 0  83  38  20  1  1 SW  14   5  83  56   0   0  0  0.
STPBRY 29 14 0  83  57  41  1  1 SW  13   4  84  60   0   0  0  0.
POCCAM 29 14 0  89  34  14  1  1 W    9   5  89  52   0   0  0  0.
MOMPOC 29 14 0  97  48  19  1  1 E   14   3  98  60   0   0  0  0.

MEAN:          85      25              13  4  86  52   0   0  0

FIRE WEATHER ZONE 512

CPANST 29 14 0 100  45  16  1  1 W    8   4 103  72   0   0  0  0.
OAKGRV 29 13 0  97  42  15  1  1 NE   8   5  98  58  55  15  0  0.

FIRE WEATHER ZONE 513

KEENWL 29 14 0  90  42  19  1  1 W   12   4  90  64   0   0  0  0.
KNWTHY 29 14 0  88  46  24  1  1 SW  12   6  88  48   0   0  0  0.
REDMTN 29 14 0  90  39  17  1  1 SW  19   4  92  69   0   0  0  0.
VICTGR 29 14 0  85  41  21  1  1 SE  12   5  88  65   0   0  0  0.
BLKMTN 29 13 0  84  59  43  1  1 W   14   5  88  56 100  39  0  0.
CAMPON 29 13 0  95  38  14  1  1 NE  11   4  98  64  41  14  0  0.
DESCAN 29 13 0  91  52  27  1  1 W   11   4  97  54  86  20  0  0.
JULIAN 29 13 0  88  44  22  1  1 E   10   7  88  51  74  21  0  0.
PINEHL 29 13 0  90  37  15  1  1 S    8   5  93  60  47  14  0  0.

MEAN:          89      22              12  5  91  59  70  22  0

FIRE WEATHER ZONE 514

VALYMO 29 13 0  90  46  22  1  1 NW   7   4  92  52  86  22  0  0.

FIRE WEATHER ZONE 515

LAGUNA 29 13 0  79  36  21  1  1 NE   6   5  81  60  64  21  0  0.

FIRE WEATHER ZONE 517

LONPNE 29 13 0  97  42  15  1  1 S    9   3 110  64  48  10  0  0.
RNDVLY 29 13 1  94  23   9  1  1 SE   9   3  94  58  25   7  0  0.

FIRE WEATHER ZONE 518

LEEVIN 29 13 1  78  27  15  1  1 SW  17   6  80  36  72  15  0  0.
MAMOTH 29 13 0  82  32  16  1  1 SW  18   4  82  38  73  15  0  0.
BLDMTN 29 13 1  73  39  29  1  1 SW  18   6  73  52  63  29  0  0.

MEAN:          78      20              18  5  78  42  69  20  0

END

SYN06I END-OF-FILE ENCOUNTERED

COMMAND?BYE


SESSION COST: $  1.93
00038.99  CPU     0000.07  TCH     0005.45  KC

OFF AT 12:52MDT 08/30/77
```

```
HHHHH
U=MAN68551,*LAX,BWF

NFDP AFFIRMS (PSH:124/65/ 4/ 3)

FOR AID, ENTER: HELP

OR CALL FTS 554-9458 OR COM (208) 384-9455

---

COMMAND?*DELETED
SET BREAKDELETED
SET DAYS 1

COMMAND?FILE READ LAC0551

FIL021 NOW EXECUTING FILE 'LAC0551'

LOS ANGELES AM FIRE WEATHER FORECAST 0800PDT TUE AUG 30 1977

SOUTHERN CALIFORNIA

...TODAY...

LOWER COASTAL ZONE
LOW CLOUDS AND FOG WITH PARTIAL AFTERNOON CLEARING. LIGHT VARIABLE
WINDS BECOMING SOUTHWEST TO WEST 8-15MPH IN AFTERNOON.
TRENDS: TEMP DOWN 5 RH UP 8  FUEL MSTR UP 1  WIND LTLCG

UPPER COASTAL ZONE
LOW CLOUDS AND FOG CLEARING DURING THE AFTERNOON. LIGHT VARIABLE
WINDS BECOMING SOUTHWEST TO WEST 8-15MPH IN AFTERNOON.
TRENDS: TEMP DOWN 8  RH UP 10  FUEL MSTR UP 1  WIND LTLCG

INTERMEDIATE ZONE
LOW CLOUDS AND FOG DISSIPATING BY MID OR LATE MORNING BECOMING
MOSTLY CLEAR THEREAFTER. LIGHT VARIABLE WINDS BECOMING
SOUTHWEST TO WEST 10-18MPH IN AFTERNOON.
TRENDS TEMP DOWN 10  RH UP 15  FUEL MSTR UP 2  WIND LTLCG

MOUNTAIN ZONE
MOSTLY CLEAR. LOCAL SOUTHERLY WINDS 10-20MPH HIGHER SLOPES AND PASSES
IN MORNING OTHERWISE LIGHT VARIABLE WINDS BECOMING SOUTHWEST TO
WEST 12-22MPH IN AFTERNOON.
TRENDS TEMP DOWN 5  RH UP 5  FUEL MSTR LTLCG  WIND SLIGHTLY STRONGER

...TONIGHT...

LOWER COASTAL ZONE
UPPER COASTAL ZONE
INTERMEDIATE ZONE
LOW CLOUDS AND FOG SPREADING INLAND OVER ZONES DURING EVENING. WINDS
BECOMING LIGHT AND VARIABLE BY MID EVENING.

MOUNTAIN ZONE
MOSTLY CLEAR BUT SOME FOG LIKELY EVEVATIONS BELOW 4000FEET AFTER
MIDNIGHT. WINDS SOUTH TO SOUTHWEST 10-20MPH AT TIMES HIGHER SLOPES
AND PASSES THROUGH NIGHT OTHERWISE LIGHT AND VARIABLE.

...WEDNESDAY...

LOWER COASTAL ZONE
UPPER COASTAL ZONE
LOW CLOUDS AND FOG DISSIPATING BY LATE MORNING OR MID DAY BECOMING
MOSTLY CLEAR THEREAFTER. CONTINUED COOL. WINDS BECOMING SOUTHWEST
TO WEST 8-15MPH IN AFTERNOON.
INTERMEDIATE ZONE
LOW CLOUDS AND FOG DISSIPATING BY MID OR LATE MORNING BECOMING
MOSTLY CLEAR THEREAFTER. WINDS BECOMING SOUTHWEST TO WEST 10-18MPH
IN AFTERNOON. NOT MUCH CHANGE TEMPERATURE OR HUMIDITY.

MOUNTAIN ZONE
PATCHY HIGH CLOUDS. WINDS FREQUENTLY SOUTHWEST TO WEST 15-25MPH.
A LITTLE COOLER.

...OUTLOOK THURSDAY...
EARLIER CLEARING LOW CLOUDS AND FOG COASTAL AND INTERMEDIATE ZONES
WITH SOME WARMING AND DRYING. MOSTLY CLEAR MOUNTAIN ZONE WITH
NORTHWESTERLY WINDS 15-25MPH LIKELY LOS PADRES AND ANGELES NF.
WINDS ELSEWHERE LIGHT AND VARIABLE BECOMING SOUTHWEST TO WEST 10-18
MPH IN AFTERNOON.

TWO MOBILE UNITS AVAILABLE...FINKE...
---

PREDICTED WEATHER AND INDICES FOR LOS ANGELES COUNTY

----------08/30/77--------FCST-------17:50GMT----------
STAT-N MS DY HR DBT RH WS LR MR HB V FF 10 100 IC SC EC OI BI FLI MC AC

CHATSW B2 30 13 100 31  7  0 20 10 5  6  6  12 55  9 60 11 28  31 0  0
DUARTE B3 30 13  91 40  7  0 20 12 5  7  6  12 44 11 57  9 30  33 0  0
LECHUS B2 30 13  90 47  4  0 20 18 5 11  4  14 24  4 50  5 18  19 0  0
PADUA  B3 30 13  92 32 14  0 20 12 5  6  7  12 53 23 58 11 43  48 0  0
VALYMO B2 30 13  95 17  7  0 18 18 5  5  3   9 63 10 72 12 32  36 0  0
VINCNT B2 30 13  95 17  8  0 18 18 5  5  3   7 63 11 74 12 34  38 0  0
WRMSPR B2 30 13  93 21 15  0 43 12 5  4  4   7 74 26 75 33 51  68 0  0
NEWHAL B1 30 13  98 28 15  0 43 12 5  5  6  11 64 23 63 28 44  56 0  0

END

SYN06I END-OF-FILE ENCOUNTERED

COMMAND?LINK FIRMODDELETED
LINK FIRMOD

FIRESCOPE FIREMOD PROGRAM (RVG/2/17/77)
ENTER FUEL TYPE,SLOPE,AGE,FINE FUEL MOISTURE,WIND,MONTH,DAY
ALL VALUES MUST BE FOLLOWED BY A COMMA
ACCEPTABLE FUEL TYPES ARE G-GRASS,B-BRUSH
SLOPE IS IN PERCENT,EG 45
AGE IS IN INTEGER YEARS,EG 22
FINE FUEL MOISTURE IS IN PERCENT,EG 4
WIND IS IN MPH
MONTH IS FOR EXAMPLE 6 IF YOU WANT JUNE
UNKNOWN VALUES CAN BE SHOWN BY 99 ENTRIES
OK INPUT DATA
HIT THE BREAK KEY ANYTIME TO LEAVE THE PROGRAM?B,30,50,2,40,9,1


-------------------------------------------------------------------------
THE EXPECTED FORWARD RATE OF SPREAD IS      345.FEET PER MINUTE

EXPECTED ELLIPSE DIMENSIONS:     LENGTH      WIDTH       AREA  PERIMETER
   (ONE HOUR PREDICTION)          (FT)        (FT)       (AC)    (CHAINS)
-------------------------------------------------------------------------
                                20698.      3400.      1273.       797.

-------------------------------------------------------------------------


OK INPUT DATA
HIT THE BREAK KEY ANYTIME TO LEAVE THE PROGRAM?(
RETURN TO AFFIRMS (YES/NO)?YES

COMMAND?BYE

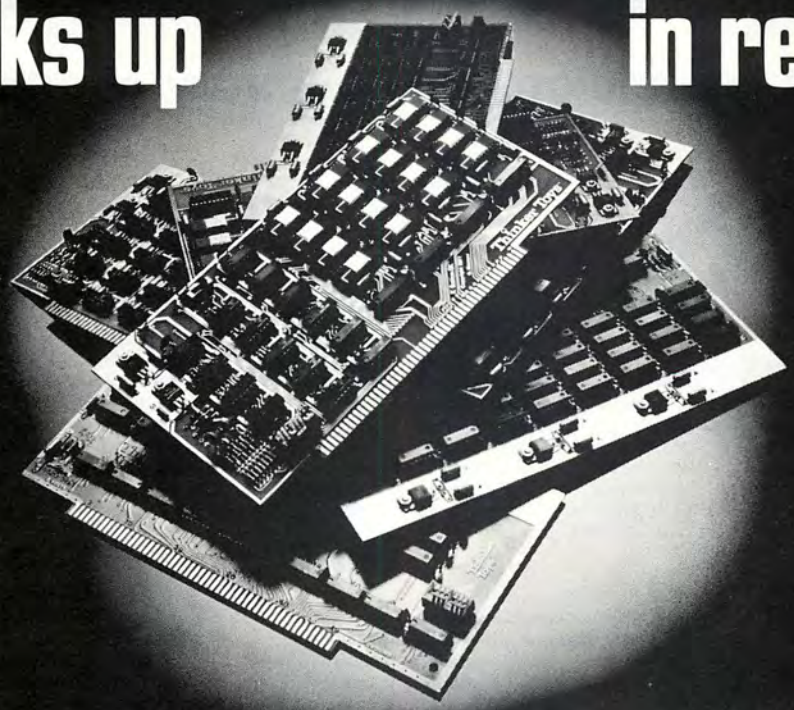
SESSION COST: $  2.95
00012.87  CPU    0000.10  TCH    0004.89  KC

OFF AT 11:54MDT 08/30/77
```

AC;	Adjective class of day
AL;	Predicted LAL for the current calendar day from observation time until midnight (Afternoon)
BI;	Burning Index
DBT;	Dry-bulb temperature
DIR;	Wind direction
DPT;	Dew point
DY;	Day of month
EC;	Energy Release Component
FF;	Fine fuel moisture
FLI;	Fire Load Index
HB;	Herbaceous vegetation condition
HMN;	24-hour minimum RH
HMX;	24-hour maximum RH
HR;	Hour valid time
IC;	Ignition Component
LR;	Lightning Risk
MC;	Manning class of day
ML;	Observed LAL from midnight to current observation time (Morning)
MR;	Man-caused Risk
MS;	Model-slope class
OI;	Occurrence Index
PD;	Observed 24-hour precipitation duration
PPTAMT;	Observed 24-hour precipitation amount
P1;	Predicted precipitation duration, first 16 hours after current day's OBS time
P2;	Predicted precipitation duration, remaining 8 hours of 24-hour period
SC;	Spread Component
STA-NO;	Station-number
TL;	Predicted LAL for Tomorrow
TMN;	24-hour minimum temperature
TMX;	24-hour maximum temperature
V;	Woody vegetation condition
W;	State of weather
WS;	Windspeed
YL;	Observed LAL for previous day (Yesterday)
10;	10-hour timelag fuel moisture (measured or computed stick moisture content)
100;	100-hour timelag fuel moisture

Figure 3b. Abbreviations used in the printouts in both Figures 3a and 3c.

Now low-cost memory stacks up in reliability!



Introducing a new generation of ECONORAM* dynamics with SynchroFresh™ reliability

Meet ECONORAM* III with SynchroFresh™, the 8Kx8 dynamic memory for S-100 bus computers that really works. And uses less than half the power of static designs. And costs just $149 for an assembled 8K.

Unlike previous attempts at building a low-cost dynamic memory, ECONORAM* III is entirely reliable ... because of SynchroFresh™, a new approach to memory refresh that is simple, elegant and totally effective.

SynchroFresh™ was invented by George Morrow, designer of the original ECONORAM*. Instead of arbitrarily interrupting your CPU to perform memory refresh cycles, Morrow designed SynchroFresh™ to weave refresh invisibly into the natural timing of the S-100 bus. SynchroFresh™ circuitry simply monitors your computer's machine states, utilizing all of the normal opportunities for memory refresh. It's that simple.

And simplicity means reliability and dramatically lower cost. That's why a SynchroFresh™ design was chosen for the first ECONORAM* dynamic, to follow in the footsteps of the largest-selling static memories for personal computers.

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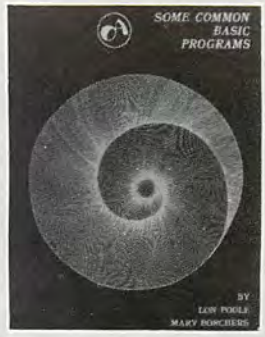

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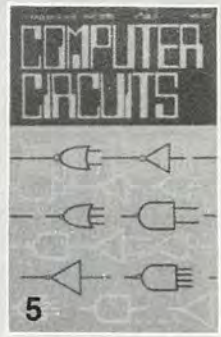

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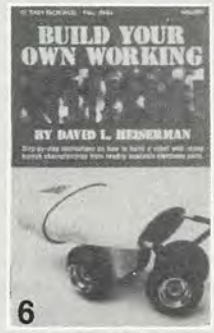

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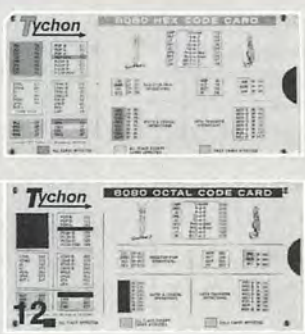

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Portable Automated

By F. V. Brock, T. M. Duncan and P. K. Govind*

INTRODUCTION

The Portable Automated Mesonet (PAM) is a computerized measurement system that collects and displays mesoscale[1] weather data from a surface array of remote sampling stations. The development of PAM began in 1973 in response to user requirements for a mesoscale data logger with the following characteristics:

- It must provide a network of ground level stations utilizing immersion sensors for wind speed and direction, air temperature, humidity, pressure and rain.
- It must be possible to deploy the network in an area and a pattern that is optimum for the phenomenon under study.
- The network must have a common time base for all observations.
- The data must be collected at a control station in real time and recorded in computer compatible form.

Since the system is to be used to study a wide range of mesoscale phenomena, including hail and thunderstorms, squall[2] lines, sea breezes, and regional air pollution, the network design must be flexible and general purpose. In order to be able to deploy the network to a specific area, the system must be portable and so the remote stations must be battery-powered.

The real-time data monitoring is required for scientific analysis and also for system monitoring in order to assure data quality. This requirement, along with portability and common time base, implies the use of radio telemetry for data collection.

Relative to conventional mesonets that employ strip chart recorders, the PAM system has the advantage of immediate data access, low operational cost (since it does not require routine servicing), and low data reduction cost since the data are recorded directly on computer-compatible magnetic tape.

In contrast to other automated mesoscale systems, PAM is portable and is research oriented. The remote station design features a programmable microprocessor which makes the design versatile and readily adaptable to users needs. The microprocessor directs data flow in the remote station, averages the data, and controls data communications.

The minicomputer-controlled base station provides synchronous sampling, centralized quality control and real-time display—thus allowing the research scientist to *watch* the surface weather patterns across the entire network.

SYSTEM OVERVIEW

The system sketched in Figure 1 can be viewed as an interacting group of subsystems:

1) Remote stations.
2) Data communications.
3) Base station.

The base station is mounted inside a trailer; the antenna tower, with six sections telescoped to a height of ≅ 50 m, is guyed beside the trailer. A directional or omnidirectional antenna is mounted at the top of the base tower depending on the spatial configuration of the remote station array relative to the base station.

The remote station antenna is placed on top of a 12 m mast at the preselected remote site. Two crossarms are attached to the mast and support sensor assemblies. The lower crossarm carries the psychrometer housing and a static pressure port at a height of 2 m above the ground. The upper crossarm carries the anemometer and wind vane at a height of 4 m above the ground. The electronics box is mounted on the top of the battery box.

The battery box contains two lead-acid batteries which supply power to the remote station. The two batteries operate continuously at acceptable levels for ≅ 14 days (over a diurnal temperature cycle in the range of 0-30°C).

Figure 2 shows a remote station on a mountain peak in Colorado. The usual 12 m mast was truncated to about 3 m in this rather unusual location. A solar panel was used to keep the batteries charged.

REMOTE STATIONS are dedicated to measurement tasks. A simplified organization of a remote station is shown in Figure 3.

SENSORS. Presently, the meteorological parameters measured by PAM are: temperature, pressure, humidity (from aspirated wet bulb), wind speed/direction, and rain. The sensors used and their measurement characteristics are specified in Table 1.

SENSOR INTERFACE. Although a specific sensor configuration is illustrated in Figure 3, the sensor interface design is general enough to accommodate other sensors, as long as their inputs can be classified as 'analog', 'digital' or 'event.' The system allows up to sixteen analog and eight event inputs.

Figure 4 shows an analog input card with a buffering

*The National Center for Atmospheric Research (NCAR), Boulder, Colorado, is operated by the University Corporation for Atmospheric Research and is sponsored by the National Science Foundation.

FOOTNOTES

[1]Mesoscale in the context of PAM refers to an area up to 160 km in diameter.

[2]Squall — a sudden violent wind often accompanied by rain or snow.

Mesonet

Figure 2. A PAM remote station located on Horseshoe Mountain at an altitude of 13,900 ft.

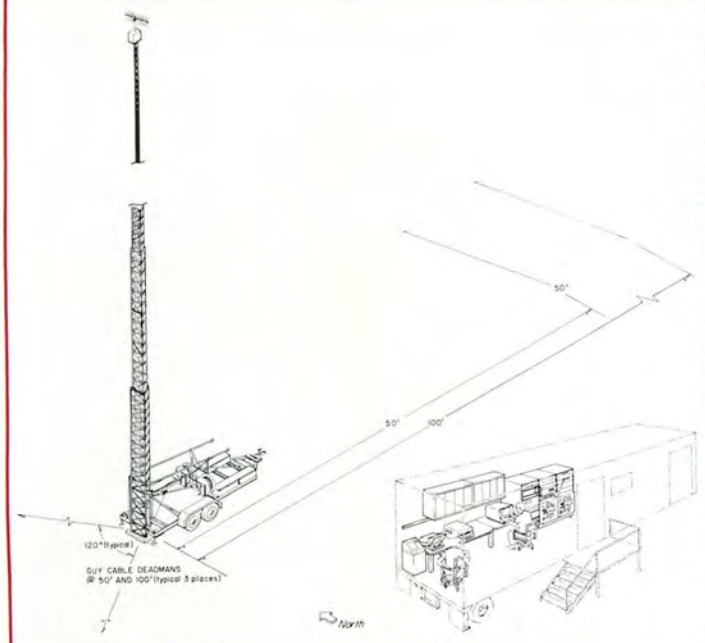

Figure 1a. A sketch of the PAM base station.

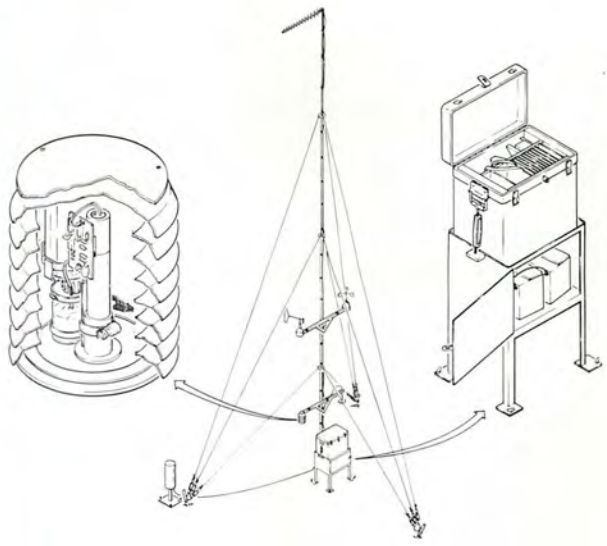

Figure 1b. A sketch of the PAM remote station.

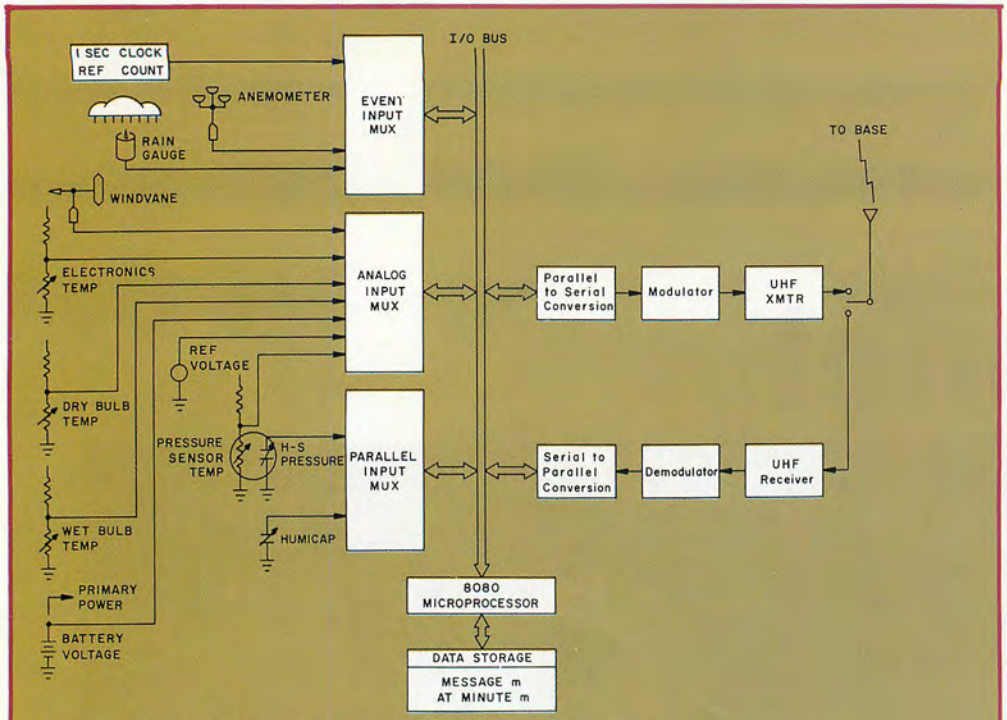

Figure 3. Block diagrams of a remote station showing the microprocessor and interfaces to the sensors. Data is transmitted to the base station over a telemetry link.

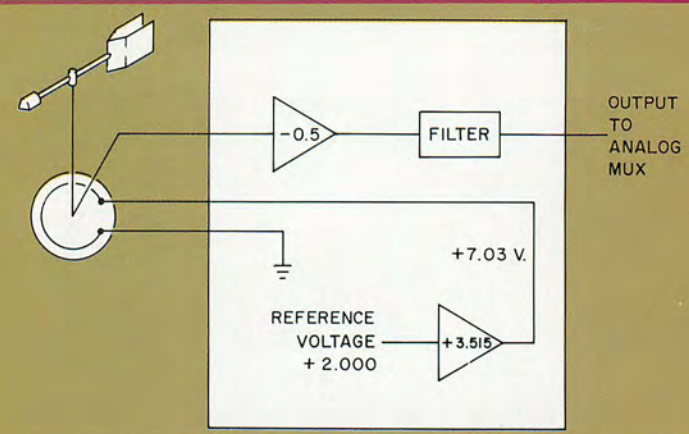

Figure 4. Analog sensor interface for the wind vane. The analog voltage sent to the multiplexer is such that when converted to a digital value, there are 4 counts per degree of direction.

Table 1. Measurement Specifications of PAM Sensors

Measurement	Sensor	Range	Accuracy	Resolution
Wind speed	Cup anemometer	0-50 m/s	± 1 m/s	0.1 m/s
Wind direction	Wind vane	0-360°	± 5°	1 degree
Pressure	Hamilton-Standard (vibrating cylinder)	600-1060 mb	± 1 mb	0.1 mb
Temperature	Bead thermistor (aspirated)	− 30 to + 50°C	± 0.5°C	0.1°C
Relative humidity	Bead thermistor (aspirated wet bulb)	10-99%	± 2%	0.5%
Rain	Tipping bucket	0-180 mm/hr	0.25 mm (T>0°C)	0.25 mm

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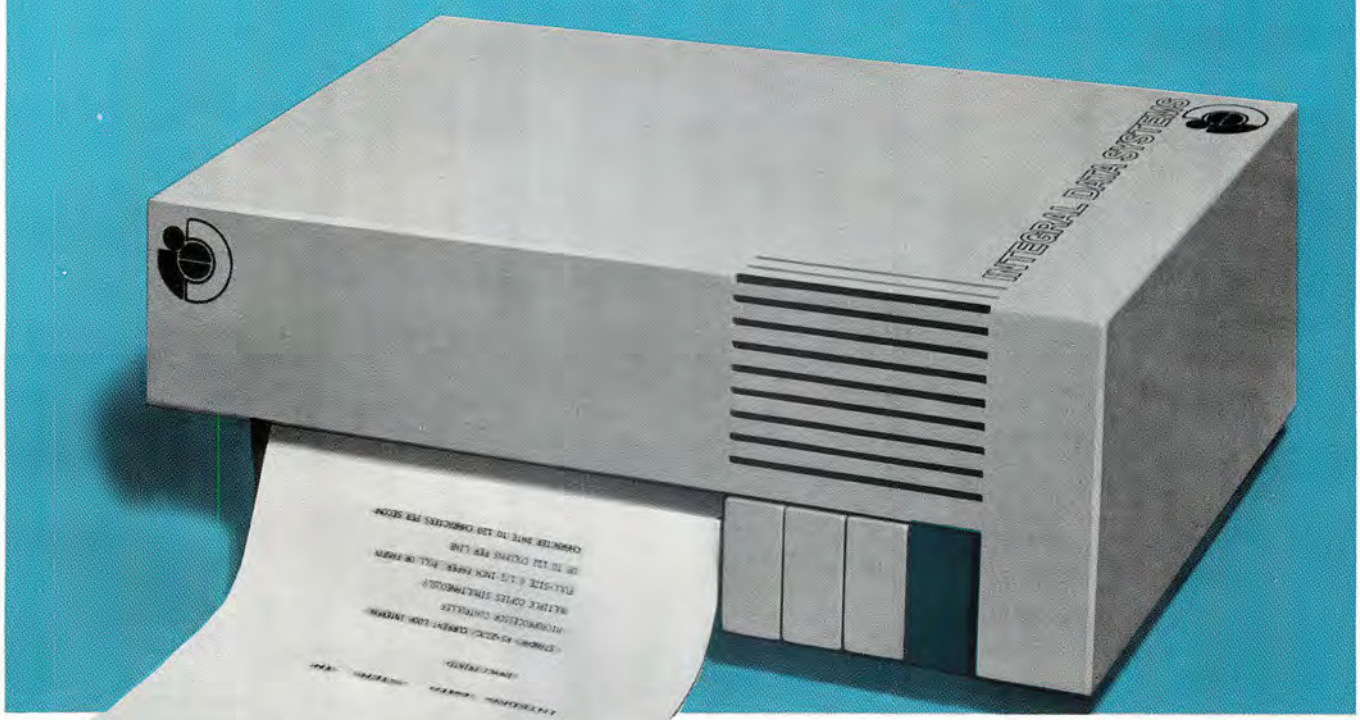

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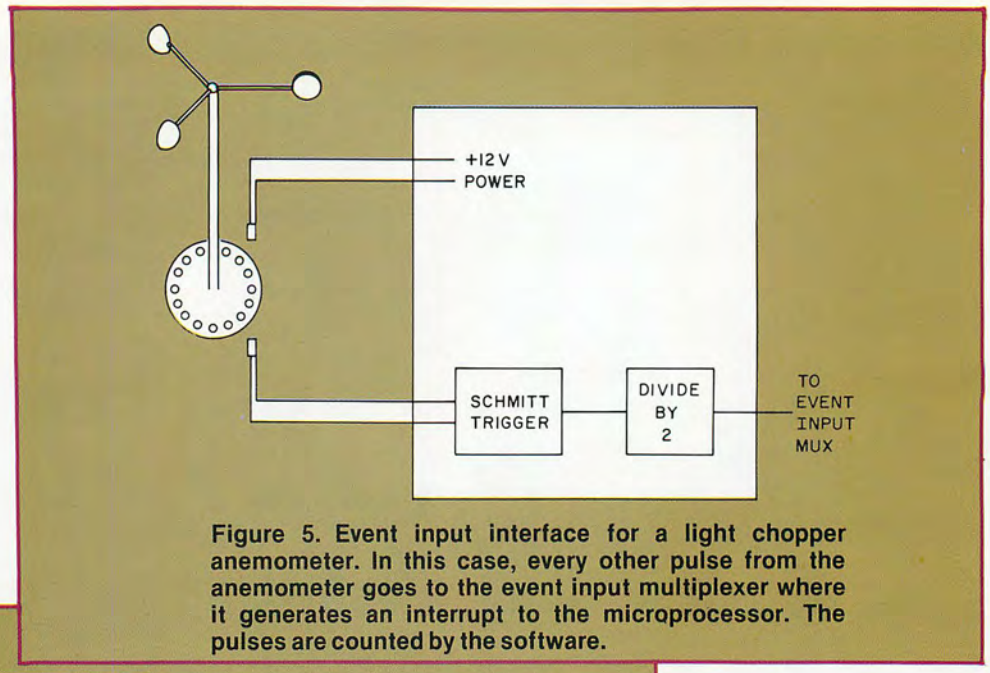

Figure 5. Event input interface for a light chopper anemometer. In this case, every other pulse from the anemometer goes to the event input multiplexer where it generates an interrupt to the microprocessor. The pulses are counted by the software.

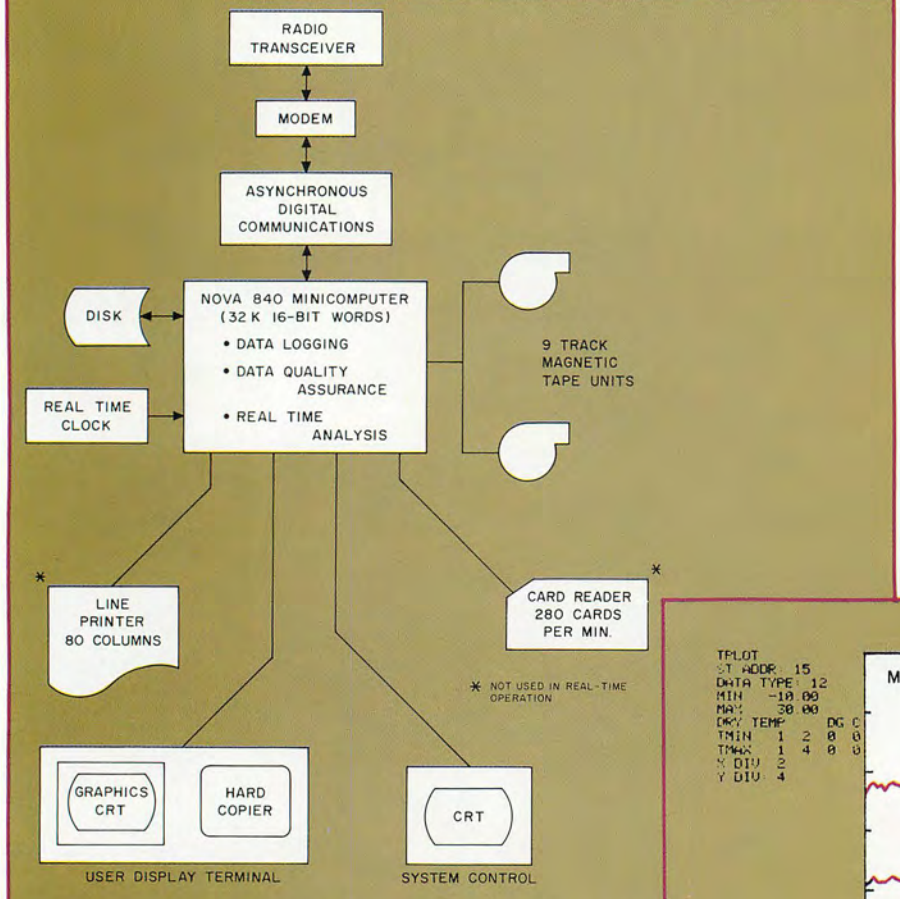

Figure 6. A block diagram of the base station structure.

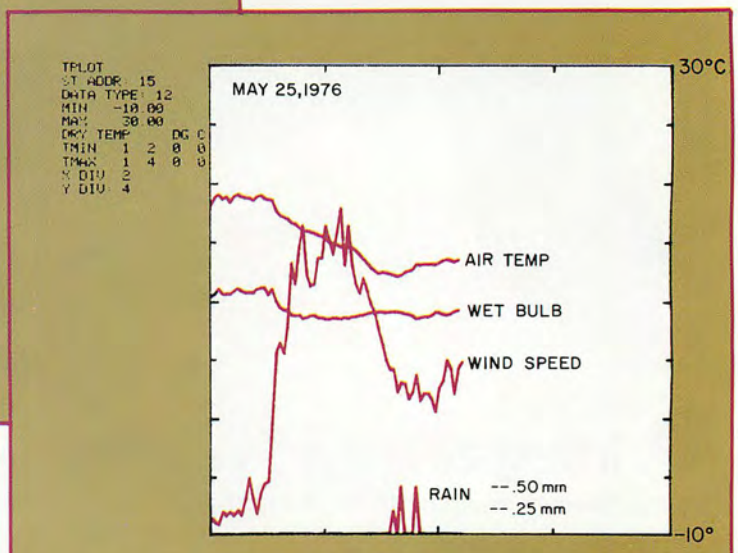

Figure 7. Sequence of meteorological events associated with the passage of a thunderstorm over a PAM remote station (25 May 1976).

amplifier to suppy a reference voltage to a wind-vane potentiometer. The electronic components of the wind-vane sensor are all on the interface card. In general, all analog interfaces provide a voltage signal compatible with the analog-to-digital converter input range of ± 5V.

Figure 5 shows a typical event input card. The input wave form is converted to digital levels by the Schmitt trigger. The light chopper anemometer generates about 46 pulses per 1 m/s of wind which is divided by 4 to yield about 12 events per 1 m/s.

All event inputs go to the event input multiplexer where they generate interrupts to the microprocessor and the events are counted in memory under program control.

MICROPROCESSOR. Data acquisition at each remote station is controlled by a microprocessor (Intel 8080). It uses 512 bytes of RAM and 1024 bytes of ROM. A cross assembler at the base station computer is used to produce machine code for the Intel 8080. The orchestration of sensor control, communications control, and data acquisition is conducted by the flow of instruction words from the stored operating program in the ROM. For example, the hardware delivers the incoming command message from the base station to the microprocessor one character at a time via the radio receiver, the modem and the UART. It is the software that checks parity bits, message format, and checksum and determines whether the message is addressed to that station. If all of these conditions are met, the command is executed. The command START synchronizes clocks and sets the averaging period. The command REPORT sends the data message currently held in memory.

In summary, the functions of the remote station software are listed below:

- Transmit data message on command.
- Keep track of time and initiate tasks at fixed intervals.
- Sample analog data a 1 s intervals and accumulate the sum.
- Count number of occurrences at each external event.
- Convert wind speed and direction from polar to rectangular coordinates and accumulate sums of the x and y components.
- At the end of the averaging period, typically one minute, divide the accumulated sums by the averaging period and put all of the data in the message format.

DATA TRANSMISSION. The base station originates command messages and remote stations originate data messages in response to commands. Both incoming and outgoing messages flow through a UART, a modem, and a radio transceiver. The UART performs a parallel-to-serial conversion, generates and checks the parity bit, and sets the data rate to 1200 baud. The modem is similar to the telephone line modem, which makes it easy to change from a radio link to a dedicated telephone line.

POWER CONSUMPTION. The power drawn from a 12 V lead-acid battery by the remote station including all of the sensors and the aspirator (for the wet- and dry-bulb temperature sensors) is 3.2W. The radio transmitter takes 10-12W to produce 2W RF output and since the duty cycle is so low (0.5 s per minute) the average power used by the transmitter is only about 0.1 W.

Two fully charged 90 amp-hour lead-acid batteries will power a remote station for 14 days at 20°C without going below the discharge knee.

DATA COMMUNICATIONS. Communication parameters for the PAM system are given in Table 2. Data transmission is asynchronous half-duplex with frequency shift modulation. Each message includes sender identification, receiver-address and validity check characters. To communicate with a group of remotes, a polling scheme is established by the base station. Each remote station checks the command stream for its address, a valid command, correct parity, and checksum. It then turns on its transmitter, sends the data message, and finally turns off its transmitter. Allowing for transmitter on/off delays and for long data messages, a conservative estimate of the polling time is ≅ 500 ms per interrogation.

Feature	Base Station	Remote Section
Operating frequency		
Transmitter	409.825 MHz	419.150 MHz
Receiver	419.150 MHz	409.825 MHz
Antenna		
Type	Stacked corner reflectors	Yagi
Gain	15 db above isotropic	12 dB above isotropic
Transmitter power	1.9 W (low power)	2 W (low power)
	22 W (high power)	13 W (high power)
Receiver threshold	– 122 dB below 1mW	– 114 dB below 1mW (without preamp)
(for error probability $\cong 10^{-3}$)		– 122 dB below 1mW (with preamp)

Table 2. Data Communication Parameters

The base station is programmed to detect errors in the telemetered message from a remote station, and to re-interrogate if necessary. The maximum number of re-interrogations is set at the base station during system configuration.

BASE STATION. The base station is the nerve center for PAM. It serves not only as a real-time information center, but also as a general purpose software development center. Figure 6 is a block diagram of the base station.

As a real-time information center, the base station has three functions: data logging, data quality assurance, and data analysis. It acquires the data transmitted by the remote stations, and logs the data set on magnetic tape after detecting communication errors. In addition, it maintains a data-base on disc. The disc data-base allows real-time display of atmospheric measurements with high resolution. The real-time display also permits the user to identify remote station malfunction when the data are questionable.

PAM is operated using a main program partitioned into executive modules and display modules. Executive modules control base-remote communications; they collect, organize, and store data on magnetic tape/disc for easy access by the display modules. The display modules are application subprograms designed for the scientist.

Two stages of PAM operation are distinguished in terms of a configuration time and a run time. Configuration time is the stage during which all parameters needed to adapt the base station software to the current field experiment are defined. Run time begins when the system control command START is entered. During the run-time stage, the base station acquires data from the remote stations, conforming to the specifications at configuration time. System operations terminate when a STOP command is entered.

System control and display functions are triggered by a set of simple commands. These commands, shown in Table 3, make it easy for the nonspecialist to operate the base station. A list of all the data types available for display is included in Table 4.

With a few minutes of instruction, a user can gain direct access to the data base using the graphics terminal. The user display commands listed in Table 3 are simple and easy to use but quite powerful. For example, a single command like TPLOT, with modifiers entered as prompted by the computer, is sufficient to generate a

plot of any specified sensor from a remote station as a function of time. A further prompt from the computer enables the user to overlay the corresponding data from another station.

OPERATIONAL USE OF PAM

FIELD RESULTS: The first operational use of PAM in a field program was in support of an intensive research program conducted in northeast Colorado to study severe convective storms producing hail. The field investigation incorporates a multiple set of measurement systems: radars, instrumented aircraft, upper air and conventional surface networks.

In order to assess transports of air mass and moisture associated with convective circulation and to define the three dimensional structure of thunderstorm airflow, an accurate definition of surface parameters is essential.

The PAM array consisted of fourteen remote stations set up along three nearly parallel lines. The base station and one remote station (spare) were located in Grover, Colorado. The network was configured to interrogate the remote stations at 60 sec. intervals and retain a 26-hr data backlog on disc for immediate operational use. All data were routinely recorded on magnetic tape for future use.

The real-time display features of the base station were used on an hourly basis to obtain winds, temperature, and dew points measured at each remote site. During special studies of intensive storms, displays were generated more frequently. Meteorologists examined the surface wind and moisture data from PAM along with radar echoes to test the utility of surface observations in predicting the evolution fo convective storm systems. The elegance of PAM to 'now-cast' surface weather patterns associated with thunderstorm development has now been convincingly demonstrated. Examples are given below.

Figure 7 shows the 'gust front' characteristics of a thunderstorm passing over a remote station. The uniform time base provided by the PAM design ensures accurate timing of surface events. Time resolution is important for studying storm movements.

Figure 8 shows the surface weather conditions accompanying various stages of a thunderstorm of moderate intensity passing across the PAM array during the afternoon of 2 June 1976. In all cases, 10-minute averages of temperature and dew point (derived from the statistical analysis display SANA) are shown on the wind vector plots. Station 10 was inoperative in Figures 8a-8c. The availability of real-time display and error diagnostics at the base station permitted us to fix the problem by the end of the day (Figure 8d).

Analyses of early hours (Figure 8a) showed a southerly flow across the network. Later in the afternoon gently converging warm winds (Figure 8b) accompanied the cumulus stage (visible just northwest of the base station). Some of the dry air still resided in the surface air in the inflow environment (near the base station). Radar surveillance by a precision radar (10 cm wavelength, 1° beam) began as soon as the storm turned to the right just east of the base station. Radar indicated that the storm was moving east. The wind vector field at the PAM sites (line 1) started showing this eastward movement (Figure 8c). As the storm matured, moving over lines 2 and 3, abrupt changes in temperature and wind indicated a down draft of precipitation-cooled air. The pronounced divergence in wind field observed at the surface in Figure 8d represents outrushing air in the convective complex.

Figure 9 is a case history (14 July 1976, 1230 MDT) of wind discontinuities (curved solid line) between distinct air masses. The moisture gradient across the network can be identified in terms of dry NW and moist SE regions

System Control Commands

Command	Function
START	Begin data acquisition
START TAPE	Begin logging data on magnetic tape
C	Log commends on data tape
STOP TAPE	Stop logging data tape
EXIT	Exit from real-time program
READ TAPE	Recreate a disc file from old data tape
SYNC	Synchronize one or all remote stations to the same time base
User Display Commands	
CNET	Reconfigure and/or recalibrate net
SYST	List system configuration and calibrations
STAT	Status; list and alter display parameters
RAW	List raw data (digital counts)
LIST	List data in engineering units
LAST	List last data fram from given remote
TPLOT	Plot data from given station versus time
XYPLOT	Plot one data against another
HIST	Plot histogram of selected data type
SANA	Statistical average and variance of given data
CONTR	Plot contours of a scalar field
WINDS	Display wind vectors at each remote station

Table 3. PAM Base Station Language

No.	Name	Units	Class
1	Base error word	Bit assignment	Communications
2	Remote error word	Bit assignment	"
3	Interrogations		"
4	Signal strength	dBm	"
5	Frequency offset	kHz	"
6	Sequence #		Diagnostic
7	Reference count		"
8	Reference voltage	volts	"
9	Battery voltage	volts	"
10	Internal temperature	°C	"
11	Pressure temperature	°C	"
12	Dry bulb temperature	°C	Meteorological
13	Wet bulb temperature	°C	"
14	Rainfall	mm in last cycle	"
15	Wind run	m/s	"
16	Wind speed	m/s	"
17	Wind direction	Geophysical degrees	"
18	Pressure	mb	"
19	Dew point	°C	Derived
20	Potential temperature	°K	"
21	Equiv. pot. temperature	°K	"
22	Mixing ratio	g/kg	"
23	Relative humidity	%	"
24	Special sensor 1	Arbitrary	Arbitrary
25	Special sensor 2	Arbitrary	"

Table 4. Displayed Data Type Definitions

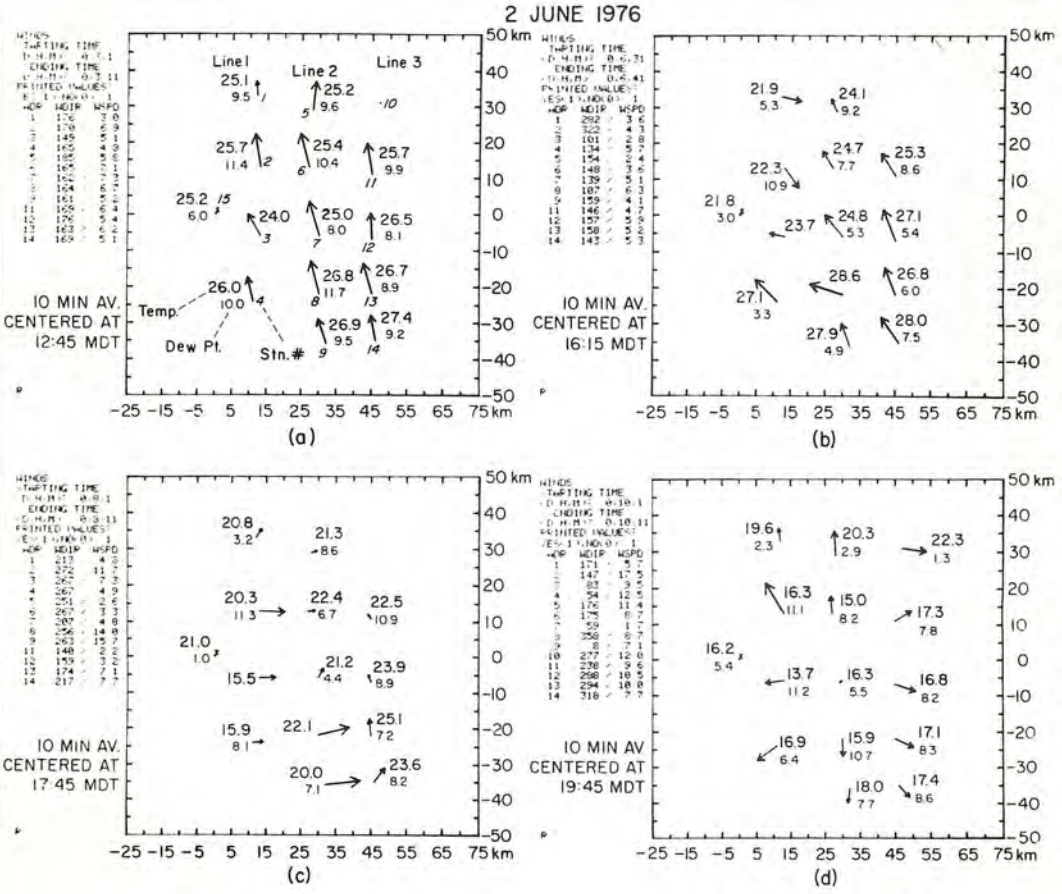

Figure 8. Surface wind field, temperature and dew points (°C) across the PAM array at various stages of storm development on 2 June 1976. 10-minute averages are centered: Figure 8a at 1245 MDT; 8b at 1615 MDT; 8c at 1745 MDT; and 8d at 1945 MDT. Station 10 was temporarily inoperative in 8a, 8b and 8c. Temperature and dew-point data at station 15 (near base) are those from a reference standard (EG & G dew pointer).

```
WINDS
STARTING TIME
(D,H,M)?  0,16,10
  ENDING TIME
(D,H,M)?  0,16,20
PRINTED VALUES?
YES(1),NO(0): 1
 ADR  WDIR/ WSPD
  1      1 /  3.1
  2      5 /  3.1
  3    241 /  3.1
  4    175 /  4.0
  5     20 /  5.4
  6     45 /  1.5
  7    204 /  2.5
  8    208 /  3.1
  9    209 /  2.7
 10    326 /  0.8
 11    135 /  4.3
 12    167 /  4.3
 13    192 /  1.9
 14    196 /  3.3
 15    223 /  2.1
```

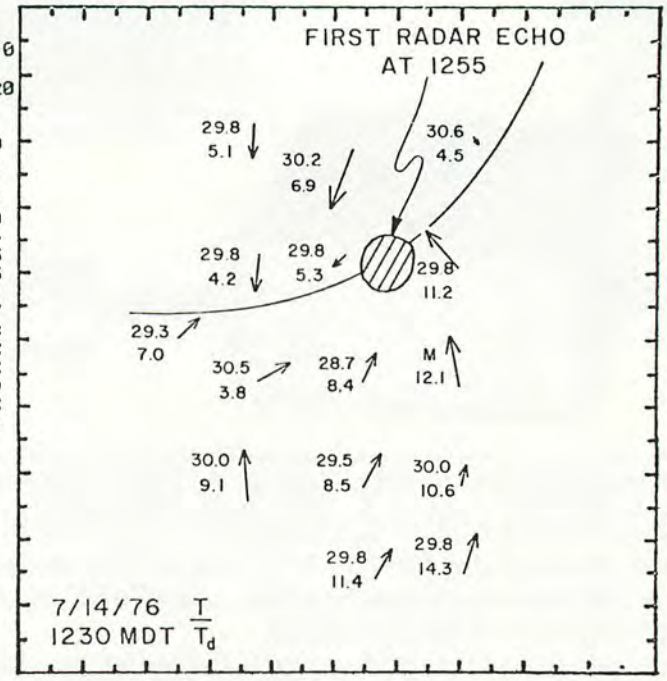

Figure 9. A case history of 14 July 1976, showing surface wind field, temperature, and dew points across the PAM array showing a confluence zone of dry and moist air masses. The radar echo confirming the convergence zone is shown schematically as a shaded circle.

(as seen in the dewpoint values). The shaded circle shows schematically the position of the first radar echo at 1255 MDT, confirming the correlation between the unique surface meteorological features measured by PAM and the location of storm cells detected by radar.

FIELD SERVICE: During the operational period it was established that routine field service was not required, only demand servicing. The many diagnostic parameters listed in Table 4 (items 1 through 11) enable the system attendant at the base station to monitor the performance of remote stations in great detail. For example, the remote stations report their battery voltage so it is possible for the attendant to schedule individual battery replacement as needed rather than on a routine schedule.

Almost every day there are periods of minimum meteorological interest when there are no storms, fronts, etc. in the area. These periods can be used to great advantage by the system operator to monitor the data and detect sensors or remote station modules that are apparently malfunctioning and therefore need attention. All kinds of sensor problems from clogged aspirators to misaligned wind vanes were detected in this way and fixed within a few hours of failure.

This approach to field service reduces the number of field personnel required (only two) and minimizes field operation cost.

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METEOROLOGY / ENVIRONMENT SPECIAL

Acoustical Analysis: The Effect of *NOISE* on the Environment

By Timothy O'Shaughnessy

Sound, like temperature, is an environmental property. In general, both are perceived by human senses. At extremes, both produce discomfort and harmful physiological effects. Sound is easily "polluted." Noise (unwanted sounds) contaminate the sounds we wish to hear. This program analyzes the combined effects of signals and noise.

Our atmosphere consists primarily of gases. Nitrogen (N_2) has the highest concentration, followed by Oxygen (O_2) followed by a large assortment of other gases. The atmosphere also contains liquid and solid particles of various sizes. The atmospheric pressure changes in relation to altitude, temperature, and pending weather conditions. The non-homogeneous properties and variations of the atmosphere introduce uncertainties into the subsequent analysis. However, statistically the air is constant enough for meaningful analysis.

Sounds are generated by the rapid displacement of molecules. In the atmosphere this displacement is propagated by and perceived as minute but rapid changes in the atmospheric pressure. In general we do not hear the relatively constant or slow changes in atmospheric pressure. Atmospheric pressure is about 14.7 pounds per square inch. In metric units this is about 1 million dynes per square centimeter or 1 million microbars.

1 ATMOSPHERE = 1 BAR = 10^6 MICROBARS ~ 10^6 dynes/cm^2

The loudest sounds tolerated by the human ear are about 300 microbars or 0.0003 of normal atmospheric pressure. Faint sounds are 200 x 10^{-6} or 0.0002 microbars. Particle displacement, the distance the molecule moves because of pressure changes, is:

$$A = \frac{\Delta P}{2\pi\, p_o f V}$$

where ΔP = change in atmospheric pressure, dynes/cm^2
p_o = density of air 1200 grams/meter^3
f = frequency of the sound transmitted
V = speed of sound = 331 meters/second

At 1000 cycles per second or 1000 Hertz the particle displacement from the loudest sounds are:

$$A = 1.2 \times 10^{-5} \text{ meters} = 0.012 \text{ millimeters}$$

Sound level in decibels is given as:

$$L_p = \left(20\log_{(10)} \frac{\Delta P}{0.0002}\right) \text{dbp}$$

ΔP = pressure change in microbars

Most sounds emitted by musical instruments and the human voice are relatively periodic: that is, the molecular displacements and atmospheric pressure changes repeat themselves at almost regular time intervals. The simplest periodic waveforms are the sinusoids (sine and cosine waves). Complex waveforms, such as a square wave, are the sum of sinusoids. These sinusoids (called harmonics) have frequencies that are intergal multiples of the base frequency (called fundamental). Sounds emitted from membranes have multiple frequencies that are not intergal multiples of a base frequency. Still other sounds are transients (spikes).

The human voice and music are random processes: that is, a sound is selected then transmitted, followed by subsequent selection and transmission. The end result is a complex waveform containing transients and short-term periodic waves.

A possible noise source is random traffic sounds adjacent to a residence in addition to the constant drone of a refrigerator motor.

The approach to analyze a situation results in modeling the signal (desired sound) as a periodic waveform and the noise as a random source. An objection to this model is that it does not duplicate the real world situation. However, this model permits calculations that are otherwise difficult to perform, and yields useful information.

The total particle displacement equals the sum of all displacements from all sources (super position). This is true except for extremely loud sounds and shock waves. Therefore:

$$A_T = \sum_{i=1}^{N} Ai = A_1 + A_2 + A_3 \ldots A_N$$

A_T = Total particle displacement

Most sources of sounds behave as "point sources." The resulting displacement equation is:

$$Si = \left(Ai/Ri\right) * \cos\left(2\pi * (t - Ri/v + Pi)\right)$$

where Si = displacement at specified point
Ai = displacement at unity distance
Ri = distance between specified point and source
t = time
V = velocity of sound
Pi = Phase offset of the source

Plane waves usually occur at large distances or in enclosed structures. The displacement equation becomes:

$$Si = Ai * \cos\left(2\pi * (t - Ri/v) + Pi\right)$$

This program assumes five point sources and one noise source. The program is easily expandable to include additional signal and noise sources. The program is easily altered to simulate plane waves and their reflections.

Figure 1a. Sinusoid Model

```
RUN
HARMONIC ANALYSIS OF POINT SOURCES
VELOCITY=331 METERS/SEC.
PHASE OFFSET IN DEGREES
SAMPLE FREQUENCY = 10KHZ

ENTER THE NUMBER OF PLOT POINTS
? 30
ENTER SOURCE PARAMETERS
DISPLACEMENTS: A0,A1
? 10,10
X CO-ORDINATES: X0,X1
? 0,0
Y CO-ORDINATES: Y0,Y1
? 0,2
FREQUENCY TERMS: F0,F1
? 500,500
PHASE TERMS: P0,P1
? 0,0
NOISE SOURCE? YES=1, NO=0
? 0
ENTER OBSERVATION POINT  X,Y
? 2,1
-10        0        +10
!     !     !     !     !
!!!!!!!!!!!!!!!!!!!!!!!!!
-    .
-      .
-        .
-          .
-            .
-              .
-                .
-                  .
-                  .
-                .
-              .
-            .
-          .
-        .
-      .
-    .
-  .
-.
-.
```

```
-  .
-    .
-      .
-        .
-          .
-            .
-              .
-                .
-                 .
-                 .
-                 .

LINE 03000
END
$
```

Figure 1b. Equal Sources — Equal Distances — 180° Phase Offset

```
RUN
HARMONIC ANALYSIS OF POINT SOURCES
VELOCITY=331 METERS/SEC.
PHASE OFFSET IN DEGREES
SAMPLE FREQUENCY = 10KHZ

ENTER THE NUMBER OF PLOT POINTS
? 30
ENTER SOURCE PARAMETERS
DISPLACEMENTS: A0,A1
? 10,10
X CO-ORDINATES: X0,X1
? 0,0
Y CO-ORDINATES: Y0,Y1
? 0,2
FREQUENCY TERMS: F0,F1
? 500,500
PHASE TERMS: P0,P1
? 0,180
NOISE SOURCE? YES=1, NO=0
? 0
ENTER OBSERVATION POINT  X,Y
? 3,1
-10        0        +10
!     !    !    !    !
!!!!!!!!!!!!!!!!!!!!!
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .
-          .

LINE 03000
END
$
```

Figure 1c. Signal with Noise

```
RUN
HARMONIC ANALYSIS OF POINT SOURCES
VELOCITY=331 METERS/SEC.
PHASE OFFSET IN DEGREES
SAMPLE FREQUENCY = 10KHZ

ENTER THE NUMBER OF PLOT POINTS
? 30
ENTER SOURCE PARAMETERS
DISPLACEMENTS: A0,A1
? 10,10
X CO-ORDINATES: X0,X1
? 0,0
Y CO-ORDINATES: Y0,Y1
? 0,2
FREQUENCY TERMS: F0,F1
? 500,500
PHASE TERMS: P0,P1
? 0,0
NOISE SOURCE? YES=1, NO=0
? 1
ENTER CO-ORDINATES  X,Y
? 1,1
PEAK DISPLACEMENT:
? 2
ENTER OBSERVATION POINT  X,Y
? 2,1
-10        0        +10
!     !    !    !    !
!!!!!!!!!!!!!!!!!!!!!
-  .
-     .
-          .
-          .
-               .
-                  .
-                  .
-   ( OFF SCALE + )
-                  .
-                .
-                .
-             .
-          .
-       .
-    .
-  .
-  .
-  .
.
-  .
-       .
-          .
-             .
-                .
-                  .
-                  .
-                .
-                .

LINE 03000
END
$
```

Figure 1d. Signal with More Noise

```
RUN
HARMONIC ANALYSIS OF POINT SOURCES
VELOCITY=331 METERS/SEC.
PHASE OFFSET IN DEGREES
SAMPLE FREQUENCY = 10KHZ

ENTER THE NUMBER OF PLOT POINTS
? 30
```

```
ENTER SOURCE PARAMETERS
DISPLACEMENTS: A0,A1
? 10,10
X CO-ORDINATES: X0,X1
? 0,0
Y CO-ORDINATES: Y0,Y1
? 0,2
FREQUENCY TERMS: F0,F1
? 500,500
PHASE TERMS: P0,P1
? 0,0
NOISE SOURCE? YES=1, NO=0
? 1
ENTER CO-ORDINATES  X,Y
? 1,1
PEAK DISPLACEMENT:
? 4
ENTER OBSERVATION POINT  X,Y
? 2,1
-10        0        +10
!    !    !    !    !
!!!!!!!!!!!!!!!!!!!!
.
-    .
-         .
-        .
-              .
-                  .
-                  .
-                 .
-  ( OFF SCALE + )
-                  .
-                .
-                .
-          .
-           .
-    .
-  .
.
-    .
-   .
-  ( OFF SCALE - )
-.
-         .
-         .
-         .
-             .
-                  .
-  ( OFF SCALE + )
-                  .
-                  .
-                   .

LINE 03000
END
$
```

Figure 2a. Aliasing at 5000 Hertz

```
RUN
HARMONIC ANALYSIS OF POINT SOURCES
VELOCITY=331 METERS/SEC.
PHASE OFFSET IN DEGREES
SAMPLE FREQUENCY = 10KHZ

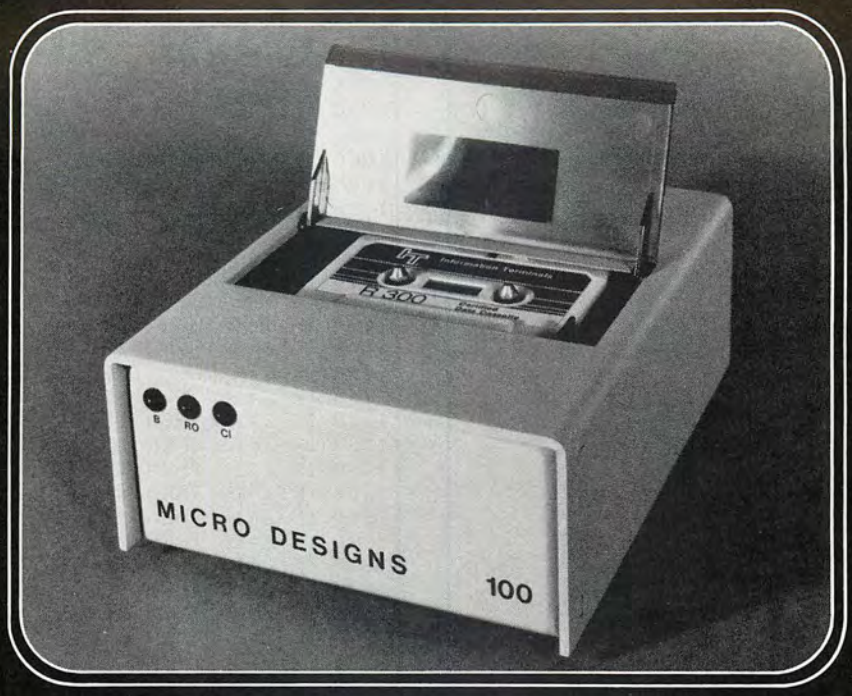
ENTER THE NUMBER OF PLOT POINTS
? 30
ENTER SOURCE PARAMETERS
DISPLACEMENTS: A0,A1
? 10,10
X CO-ORDINATES: X0,X1
? 0,0
Y CO-ORDINATES: Y0,Y1
? 2,0
FREQUENCY TERMS: F0,F1
? 5000,5000
PHASE TERMS: P0,P1
? 0,0
NOISE SOURCE? YES=1, NO=0
? 0
ENTER OBSERVATION POINT  X,Y
? 3,1
-10        0        +10
!    !    !    !    !
!!!!!!!!!!!!!!!!!!!!
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .
-           .
-         .

LINE 03000
END
$
```

Figure 2b. First Three Harmonics of a Square Wave

```
RUN
HARMONIC ANALYSIS OF POINT SOURCES
VELOCITY=331 METERS/SEC.
PHASE OFFSET IN DEGREES
SAMPLE FREQUENCY = 10KHZ

ENTER THE NUMBER OF PLOT POINTS
? 40
ENTER SOURCE PARAMETERS
DISPLACEMENTS: A0,A1,A2,A3,A4
? 10,3.333,2.0,0,0
X CO-ORDINATES: X0,X1,X2,X3,X4
? 0,0,0,0,0
Y CO-ORDINATES: Y0,Y1,Y2,Y3,Y4
? 0,0,0,0,0
FREQUENCY TERMS: F0,F1,F2,F3,F4
? 500,1500,2500,0,0
PHASE TERMS: P0,P1,P2,P3,P4
? 90,90,90,90,90
NOISE SOURCE? YES=1, NO=0
? 0
ENTER OBSERVATION POINT  X,Y
? 2,0
-10        0        +10
!    !    !    !    !
!!!!!!!!!!!!!!!!!!!!
-           .
-         .
-       .
-      .
-       .
-        .
-        .
-       .
-      .
-       .
-         .
-           .
-             .
-              .
-               .
-                .
```



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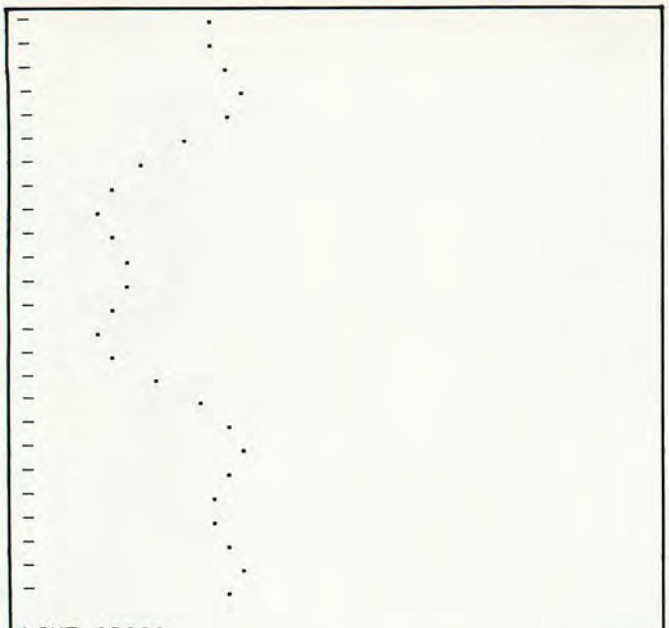
Oakland, CA 94606
(415) 465-1861

CIRCLE INQUIRY NO. 24



```
LINE 03000
END
$
```

Figure 3a. List

```
100 PRINT"HARMONIC ANALYSIS OF POINT SOURCES"
105 PRINT"VELOCITY=331 METERS/SEC."
110 PRINT"PHASE OFFSET IN DEGREES"
115 PRINT"SAMPLE FREQUENCY = 10KHZ"
120 PRINT""
125 PRINT"ENTER THE NUMBER OF PLOT POINTS"
130 INPUT L
200 V=331
205 K0=2*3.14159
210 K1=1/K0
215 K2=K0/360
225 PRINT"ENTER SOURCE PARAMETERS"
235 PRINT"DISPLACEMENTS: A0,A1,A2,A3,A4"
240 INPUT A0,A1,A2,A3,A4
250 PRINT"X CO-ORDINATES: X0,X1,X2,X3,X4"
260 INPUT X0,X1,X2,X3,X4
270 PRINT"Y CO-ORDINATES: Y0,Y1,Y2,Y3,Y4"
280 INPUT Y0,Y1,Y2,Y3,Y4
290 PRINT"FREQUENCY TERMS: F0,F1,F2,F3,F4"
300 INPUT F0,F1,F2,F3,F4
310 PRINT"PHASE TERMS: P0,P1,P2,P3,P4"
315 INPUT P0,P1,P2,P3,P4
320 PRINT"NOISE SOURCE? YES=1, NO=0"
330 INPUT N0
340 IF N0=0 THEN 400
350 PRINT"ENTER CO-ORDINATES  X,Y"
360 INPUT N1,N2
370 PRINT"PEAK DISPLACEMENT:"
380 INPUT N3
390 GOTO 500
400 N1=0
410 N2=0
420 N3=0
500 PRINT"ENTER OBSERVATION POINT  X,Y"
510 INPUT O1,O2
600 R0=SQR((O1-X0)↑2+(O2-Y0)↑2)
610 R1=SQR((O1-X1)↑2+(O2-Y1)↑2)
620 R2=SQR((O1-X2)↑2+(O2-Y2)↑2)
630 R3=SQR((O1-X3)↑2+(O2-Y3)↑2)
640 R4=SQR((O1-X4)↑2+(O2-Y4)↑2)
700 N4=SQR((O1-N1)↑2+(O2-N2)↑2)
800 PRINT"-10        0        +10"
810 PRINT"!    !    !    !    !"
820 PRINT"!!!!!!!!!!!!!!!!!!!!!"
890 T=0
900 S0=(A0/R0)*COS(K0*F0*(T-R0/V)+P0*K2)
910 S1=(A1/R1)*COS(K0*F1*(T-R1/V)+P1*K2)
920 S2=(A2/R2)*COS(K0*F2*(T-R2/V)+P2*K2)
930 S3=(A3/R3)*COS(K0*F3*(T-R3/V)+P3*K2)
940 S4=(A4/R4)*COS(K0*F4*(T-R4/V)+P4*K2)
1000 N5=(N3/N4)*(RND(0)-0.5)*2
1010 Z=S0+S1+S3+S4+N5
1020 Z=Z+10.5
1030 Z=INT(Z)
1040 IF Z < 0 THEN 1800
1050 IF Z > 20 THEN 1830
1060 IF Z=0 THEN 1300
1070 IF Z=1 THEN 1320
1080 IF Z=2 THEN 1340
1090 IF Z=3 THEN 1360
1100 IF Z=4 THEN 1380
1110 IF Z=5 THEN 1400
1120 IF Z=6 THEN 1420
1130 IF Z=7 THEN 1440
1140 IF Z=8 THEN 1460
1150 IF Z=9 THEN 1480
1160 IF Z=10 THEN 1500
1170 IF Z=11 THEN 1520
1180 IF Z=12 THEN 1540
1190 IF Z=13 THEN 1560
1200 IF Z=14 THEN 1580
1210 IF Z=15 THEN 1600
1220 IF Z=16 THEN 1620
1230 IF Z=17 THEN 1640
1240 IF Z=18 THEN 1660
1250 IF Z=19 THEN 1680
1260 IF Z=20 THEN 1700
1300 PRINT"."
1310 GOTO 2000
1320 PRINT"-."
1330 GOTO 2000
1340 PRINT"- ."
1350 GOTO 2000
1360 PRINT"-  ."
1370 GOTO 2000
1380 PRINT"-   ."
1390 GOTO 2000
1400 PRINT"-    ."
1410 GOTO 2000
1420 PRINT"-     ."
1430 GOTO 2000
1440 PRINT"-      ."
1450 GOTO 2000
1460 PRINT"-       ."
1470 GOTO 2000
1480 PRINT"-        ."
1490 GOTO 2000
1500 PRINT"-         ."
1510 GOTO 2000
1520 PRINT"-          ."
1530 GOTO 2000
1540 PRINT"-           ."
1550 GOTO 2000
1560 PRINT"-            ."
1570 GOTO 2000
1580 PRINT"-             ."
1590 GOTO 2000
1600 PRINT"-              ."
1610 GOTO 2000
1620 PRINT"-               ."
1630 GOTO 2000
1640 PRINT"-                ."
1650 GOTO 2000
1660 PRINT"-                 ."
1670 GOTO 2000
1680 PRINT"-                  ."
1690 GOTO 2000
1700 PRINT"-                   ."
1710 GOTO 2000
1800 PRINT"-  ( OFF SCALE - )"
1810 GOTO 2000
1830 PRINT"-  ( OFF SCALE + )"
1840 GOTO 2000
2000 T=T+0.0001
2010 IF T > L/10000 THEN 3000
2020 GOTO 900
3000 END
$
```

Note for Figure 3.
Delete
lines 620 — 640
920 — 940

Reduce number of variables on lines From 235 to 315

METEOROLOGY / ENVIRONMENT SPECIAL

A Program to Calculate Winds Aloft Using a Hewlett-Packard 25 Hand Calculator

By Brian W. Finke*

INTRODUCTION

A method of calculating winds aloft data from theodolite observation is offered without resorting to the use of plotting boards. This program, utilizing the Hewlett-Packard 25 hand calculator, was originally intended for fire weather mobile unit use at going fires where time and space are at a premium. No new theory has been developed. The tangent plane approximation is the only compromise; but within the accuracy of the observations, this approximation results in no error.

METHOD

The program (Figure 1) is keyed into the calculator. If an HP 25C model is utilized, the program need only be initially inserted — as the HP 25C has a nonvolatile memory and the program will remain in the calculator's program memory until cleared (even during battery changes).

A constant "K" must now be calculated and stored in memory register 0. This constant will determine units of output for given units of input, i.e., meters/sec., knots, m.p.h., etc. A factor of .01 must be included in this constant to scale the wind speed for the output display.

Wind calculations can now be made using assumed balloon ascension rates (from tables) or actual heights from the pressure-altitude curve from a radiosonde run and the theodolite data.

1) Let:
   - H1 = Height at time T
   - $\theta 1$ = Azimuth angle at time T
   - $\alpha 1$ = Elevation angle at time T
   - H2 = Height at time T + ΔT
   - $\theta 2$ = Azimuth angle at time T + ΔT
   - $\alpha 2$ = Elevation angle at time T + ΔT.
2) Now store:
   - H1 in R1, (H1 STO 1)
   - $\alpha 1$ in R2, ($\alpha 1$ STO 2)
   - $\theta 1$ in R3, ($\theta 1$ STO 3)
   - H2 in R4, (H2 STO 4)
   - $\alpha 2$ in R5, ($\alpha 2$ STO 5)
   - $\theta 2$ in R6, ($\theta 2$ STO 6).
3) Then push R/S key — in about 5 seconds the wind is displayed in the form DDD.VV where DDD is the wind direction in degrees and VV is the speed.
4) For the next level store H1, $\alpha 1$, etc. Repeat to end of run.

This program was used operationally at WSO(Av) LAX by Mr. Don DePauw. He experienced a time-saving factor of 25-50%. Simultaneous calculations were made using both the calculator and plotting board. No discernible difference was noted in accuracy, although one would expect the calculator to be far superior as internal calculations are carried out to 10 significant digits.

CONCLUSIONS

This program was developed for fire-weather mobile-unit use; however, it can be applied to other needs with no change. The program was supplied to the State of North Carolina Forestry Department for use in a smoke management program. It was supplied to the United States Forest Service Pacific Northwest Fire Behavior Team for pibal calculations at going wild fires.

*Weather Service Forecast Office, National Weather Service Western Region, NOAA, Los Angeles, California.

HP-25 Program Form

Title PILOT BALLOON REDUCTION PROGRAM Page 2 of 2

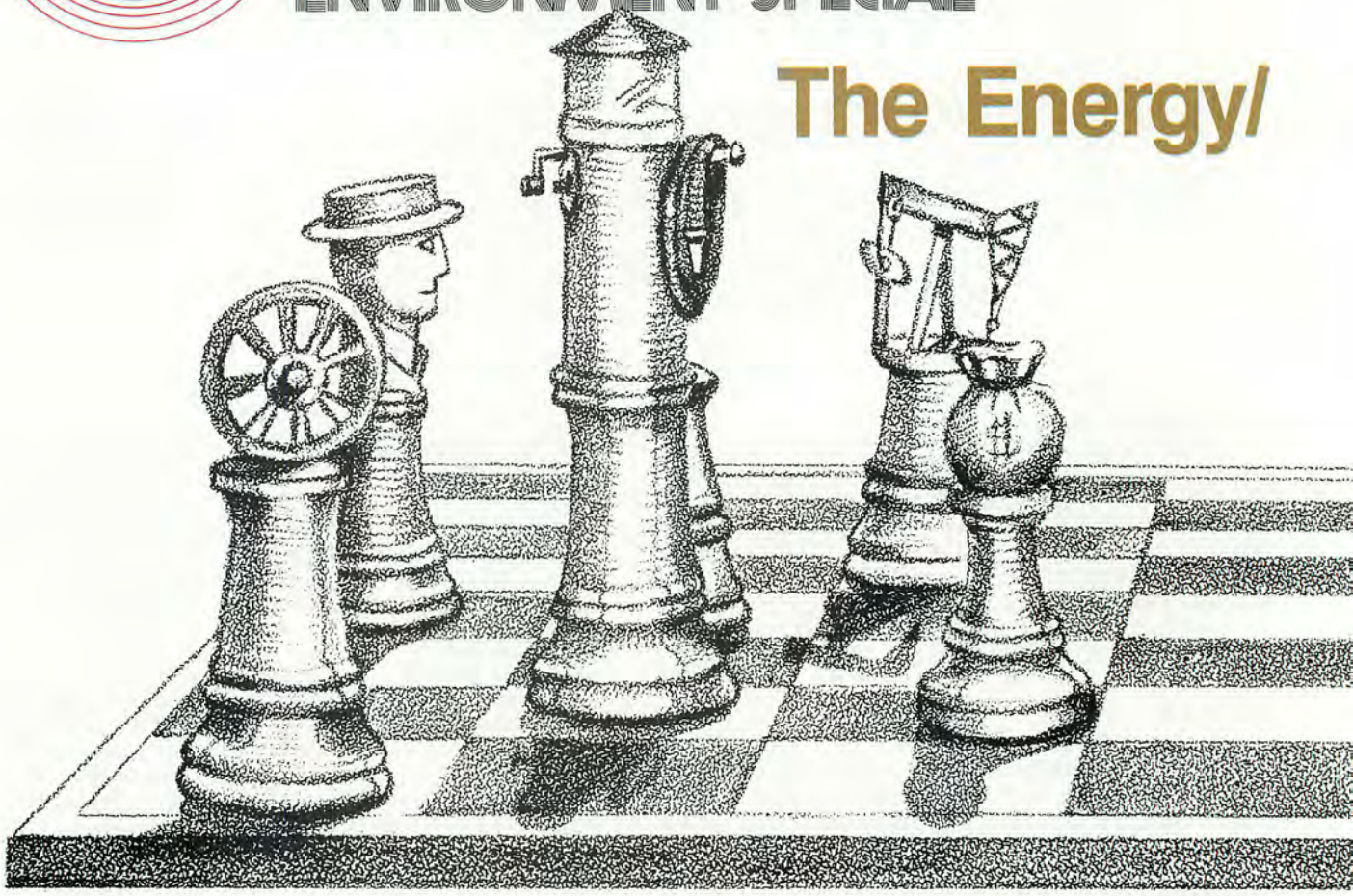
Switch to PRGM mode, press [f] [PRGM], then key in the program:

LINE	DISPLAY CODE	KEY ENTRY	X	Y	Z	T	COMMENTS
00			-	-	-	-	Enter height and
01		RCL1	H1	-	-	-	elevation angle.
02		RCL2	=1	H1	-	-	
03		f TAN	tan =1	H1	-	-	Calculate horizon-
04		g 1/x	ctn =1	H1	-	-	tal distance out.
05		X	H1 ctn=1	-	-	-	
06		9	9	H1 ctn =1	-	-	
07		0	90	H1 ctn =1	-	-	Azimuth angle
08		RCL3	θ1	90	H1 ctn =1	-	adjustment.
09		-	90-θ1	H1 ctn =1	-	-	
10		X $\leq$ y	H1 ctn =1	90-θ1	-	-	
11		f → R	x1	y1	-	-	Calculate x1 and
12		RCL4	CR4	x1	y1	-	y1. Retrieve R4
13		g x=0	CR4	x1	y1	-	test R4, If R4=0,
14		STO 27	CR4	x1	y1	-	If R4≠0, X1 stored
15		R↓	x1	y1	-	CR4	in R1, Y1 stored
16		STO 1	x1	y1	-	CR4	in R2, retrieve θ2
17		X $\leq$ y	y1	x1	-	CR4	and store in R3.
18		STO 2	y1	x1	-	CR4	
19		RCL6	θ2	y1	x1	-	
20		STO 3	θ2	y1	x1	-	
21		RCL 4	H2	θ2	y1	x1	Retrieve H2
22		RCL 5	=2	H2	θ2	y1	Retrieve =2
23		0	0	=2	H2	θ2	
24		STO 4	0	=2	H2	θ2	Store 0 in R4
25		R↓	=2	H2	θ2	0	Position H2 and =2
26		GTO 03	=2	H2	θ2	0	
27		R↓	x2	y2	-	0	Position X2 and Y2
28		RCL 1	x1	x2	y2	0	Retrieve X1 and
29		-	x2-x1	y2	0	0	obtain (X2-X1)
30		x$\leq$y	y2	x2-x1	0	0	Position Y2
31		RCL 2	y1	y2	x2-x1	0	Retrieve Y1
32		-	y2-y1	x2-x1	0	0	Obtain (Y2-Y1)
33		x$\leq$y	x2-x1	y2-y1	0	0	Obtain windspeed
34		g→ P	IV1	θ	0	0	and direction.
35		RCL 0	K	IV1	θ	0	Scale windspeed
36		X	.VV	θ	0	0	make adjustment
37		x$\leq$y	θ	.VV	0	0	back to meteorolo-
38		9	9	θ	.VV	0	gical coordinate
39		0	90	θ	.VV	0	system.
40		+	θ	90	.VV	0	
41		CHS	90-θ	V	0	0	If wind direction
42		g x≥0	90-θ	V	0	0	<0,
43		GTO 48	90-θ	V	0	0	
44		3	3	90-θ	.VV	0	Add 360° to wind
45		6	36	90-θ	.VV	0	direction.
46		0	360	90-θ	.VV	0	Truncate wind
47		+	360+(90-θ)	.VV	0	0	direction and add
48		f INT	DDD.00	.VV	0	0	to scaled wind
49		+	DDD.VV	0	0	0	speed.

REGISTERS	
R_0	K
R_1	H1 x1
R_2	=1 y1
R_3	ΔT θ2
R_4	H2 0
R_5	=2
R_6	θ2
R_7	

METEOROLOGY / ENVIRONMENT SPECIAL

The Energy/



The energy crisis is clearly not a subject to be taken lightly, but with all higher animals, serious survival skills are learned through games. Computer modeling is one such means of "game" learning.

In response to the imminent need to take inventory of the nation's energy requirements and consumption, a Montana State University professor, Dr. John Amend developed the interactive analog computer to model the world and national energy situation. This was accomplished four years ago under a contract with the Atomic Energy Commission.

The simulator is an electronic computer-like system with one main control panel and five feed-in panels (see Photos 1a and 1b). A technical description follows in the companion article by Dr. Amend. Nearly as complex as the energy crisis itself, the simulator encompasses nearly every aspect of supply and demand. The main panel contains the situation today: resources available (coal, oil, gas, electricity), environmental impact, personal energy use and population. Two other panels break down demand into different areas: agricultural and industrial, transportation and consumer demand. These data blocks must be balanced against available energy programmed opposite them on the panel. (See Figures 1a through 1g). One panel of the regional holds the production capability in fossil resources, one sets limits on imports and exports while another deals with energy conversion needed to meet demands. The users are free to set the control knobs to any position needed, but everything must be in balance. If the data input represents imbalance, lights flash and a buzzer sounds; the game is lost, or in another analogy, the machine said "tilt" and the world is in trouble.

In programming the National Simulator, Dr. Amend and his team addressed themselves to defining the problem of "the energy crisis" which they defined as four-fold and only partly technical. It is in effect a closed loop composed of several interdependent sectors such as research and development, energy production and conversion, energy use and finance for energy production as well as research and development. The situation is complicated by the fact that energy users are outstripping energy supplies while production capability is limited by the slow rate of research and development. Short-term solutions would be to decrease energy needs to match capability while long-term answers are to increase production capability by increasing research and development of new sources or upgrading of culled sources.

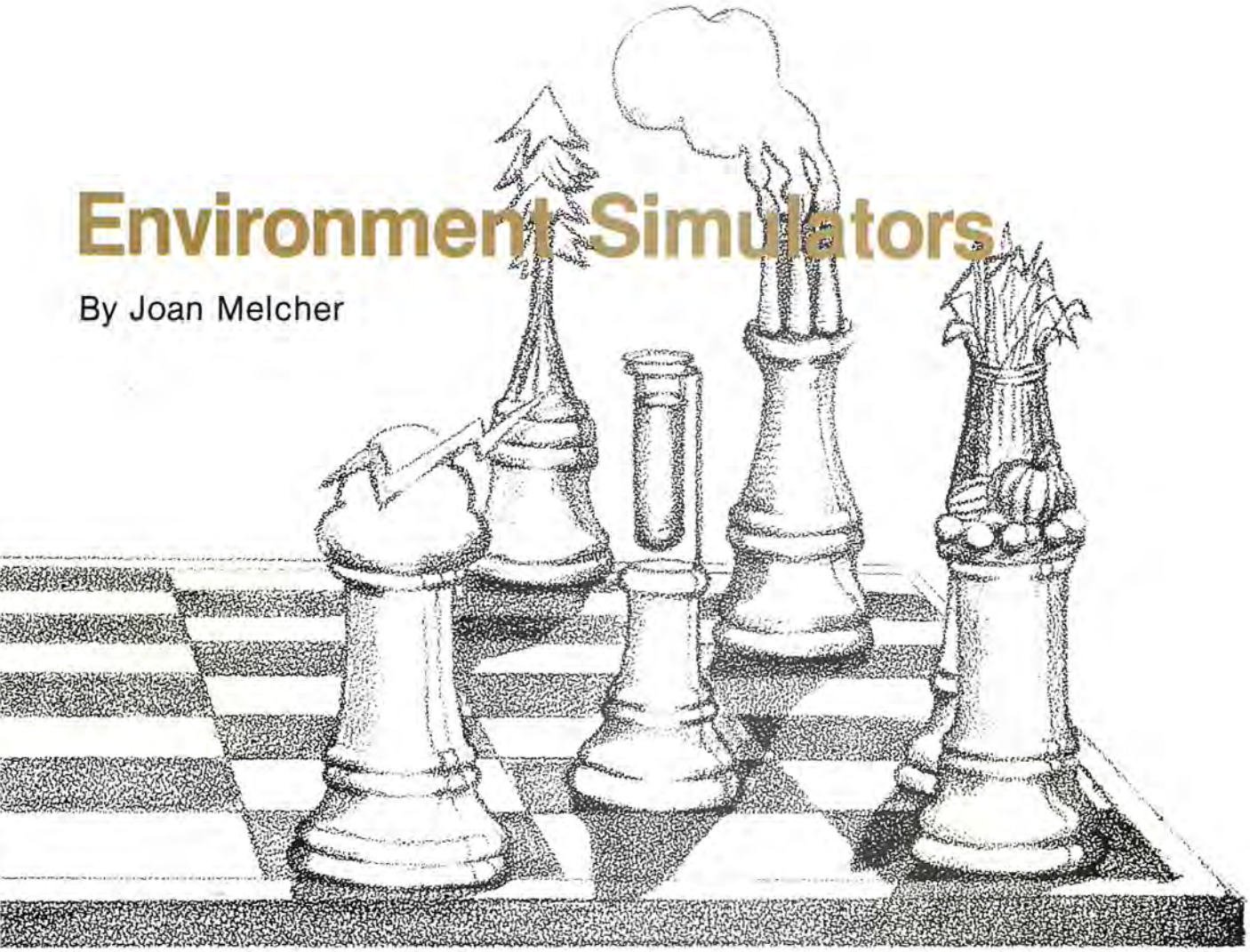
Generally non-numerical in its readout, the simulator can be used with an audience of 20 to 40 people operating portable control "lap" consoles connected to the simulator by small multi-conductor cables.

The simulator is divided into six functional blocks. A four-digit clock represents time from the present to 9999 years hence. Time normally progresses at a rate of 100 years per minute, but the flow rate may be changed to 25 years per minute. (See Photo 2)

An energy resource area contains known energy

Environment Simulators

By Joan Melcher



reserves — coal, petroleum, natural gas, hydroelectric and nuclear power, and "new technology" (representing, principally, solar and fusion processes). A system of digital integrators and circuit-board mounted switches program reserves and participants draw from the reserves at a chosen rate. The integrator circuits monitor the rate of use of each resource, calculate the amount of reserve as time progresses, and indicate the percentage of each resource remaining with a light-emitting diode display. When a reserve is depleted the lights go out, a red warning lamp comes on and no more energy is available from that resource.

Environmental impact on the simulator indicates the pollution caused by energy conversion with three comparison circuits which sum weighted rate-of-use signals from various resource areas. Colored lights indicate the level of air pollution, unused heat, and nuclear waste.

The energy pools accept and sum energy production from the resource areas. They also receive and sum the signals from the demand area and compare energy supply with energy demand. Balance is indicated with a five-lamp string: red (-); amber, green (OK); amber, blue (+). Excess energy production causes the (+) to light; energy shortage causes the (-) indicator to flash and an audible alarm to sound. The participants must keep the energy pools balanced as their simulation progresses either by increasing or shifting energy resources, or by decreasing demands.

Energy demands are categorized in four areas: industrial, transportation, household and commercial utility, and agriculture. Each control is programmed according to the present level of energy use in a designated area. Total demand is affected by the settings of personal energy demand and population growth. Personal energy demand is indicated on a digital voltmeter and population is displayed on a string of ten light-emitting diodes. The balance between population and agricultural production is displayed in a food pool. (See Photo 3)

The system is controlled by a number of variables accessible to the participants. Participants create their own energy strategy, given the present situation and the possible interaction of the factors they are programming.

After observing the result of a given simulation the participants can discuss the strong and weak points of their strategy, or energy policy, modify the strategy, press the reset button, and try a new strategy. One of the principal values of the simulator is its ability to place people in a decision-making situation involving real variables and alternatives, and to project for them the probable consequences of their policies or strategies.

Often participants have the world in dire straits in 45 seconds after their simulation begins. The common reaction is disbelief; they don't think that it is possible. Dr. Amend comments, "Never in history have we faced a situation like that, because prior to this time growth rate has been slow enough so we've been able to assimilate it."

The energy/environment simulator is a valuable educational tool to raise the level of consciousness of the public.

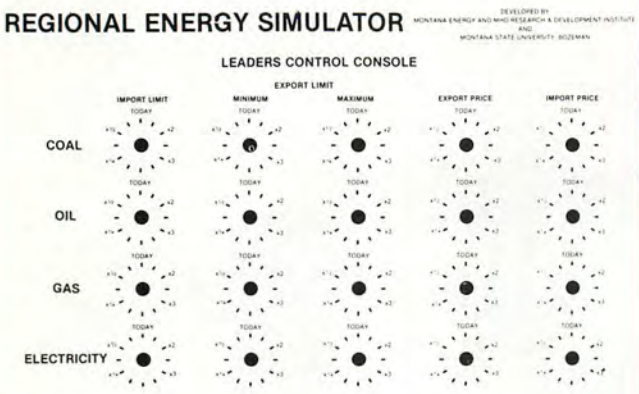


Figure 1a.

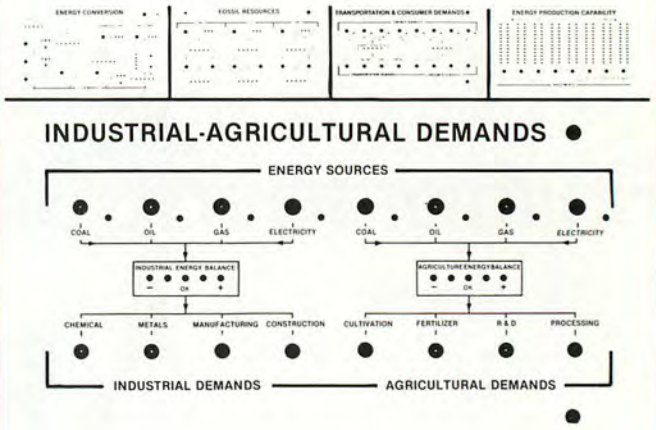


Figure 1d.

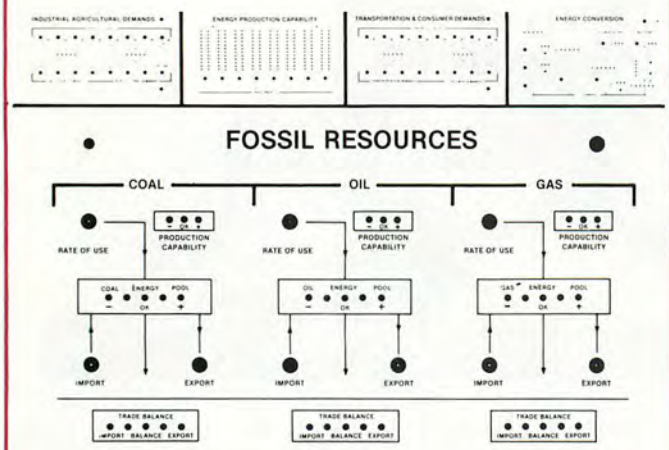


Figure 1b.

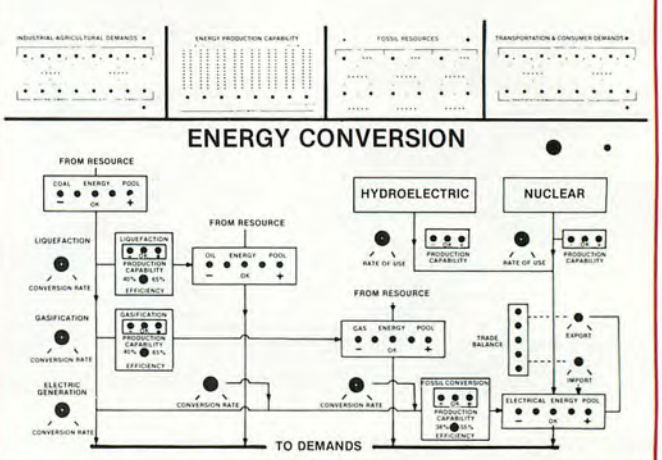


Figure 1e.

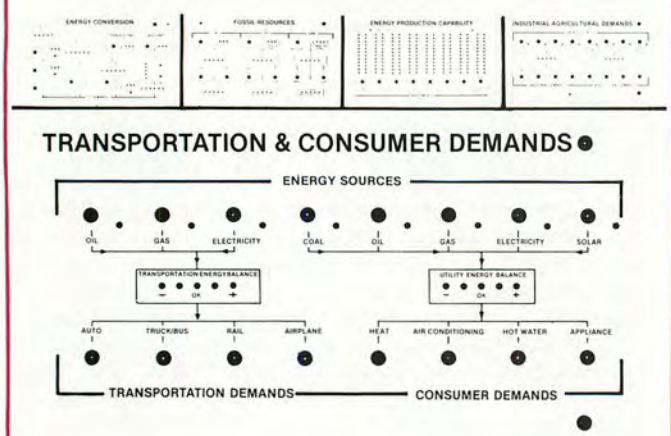


Figure 1c.

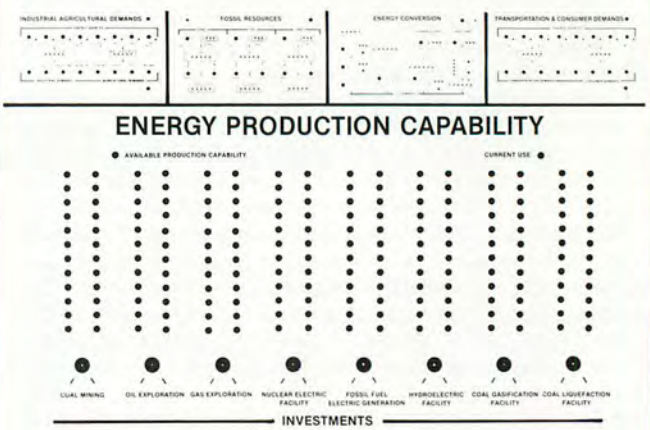


Figure 1f.

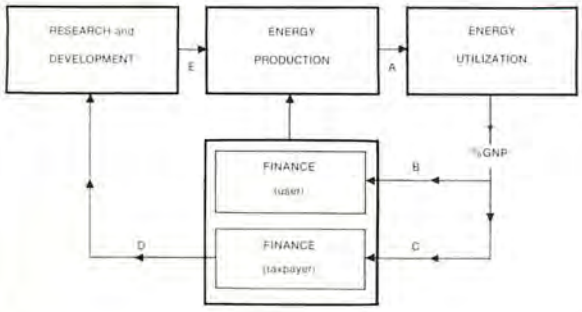


Figure 1g.

Dr. Amend estimates that over a million people have been reached by the National Simulator. Since people tend to ignore environmental facts, or prefer not to think about them, the simulator presents the data in a very real way. One 21-year-old woman astonished Dr. Amend with her response. Her simulation resulted in an exhaustion of coal reserves. She asked how long it took for "coal to grow back." She had assumed a timespan of 200 or 300 years.

There are now about 60 National Simulators in use throughout the country. The educational program is sponsored by the U.S. Energy Research Development Administration (ERDA). A regional model was developed last year in Montana by Dr. Amend and Byron Jones, a mechanical engineer for the Montana Energy and MHD Research and Development Institute along with a team from Montana State University. The Regional Simulator is able to take a broader look at the energy picture in one designated area.

Originally the regional model utilized the National Simulator as its main console, but a new main console has been designed recently for the regional model. The Montana Energy Research Institute that funded its development now uses the regional model in demonstrations across the state.

The regional model is an extension of the National Simulator with a more extensive break-down of energy and environmental factors. It goes beyond what the national model can do in several areas. The Regional has special ability to deal with imports and exports. The import and export capability ties the one specific region to the world and shows the net effect on the regional trade balance regarding energy imports and exports. It also gives an indication of overall cost of energy. If limits are not set on imports and exports it is assumed the rest of the world can supply a region's demands indefinitely.

Like the national "parent" installation, the main panel for the Regional Simulator holds a given situation — resources available (coal, oil, gas, electricity), environmental impact, trade balance, personal energy use, population. Two other panels break demand down into different areas — agricultural and industrial, transportation and consumer demand. The two areas must balance against available energy. Another panel controls the rate of production of fossil fuels and resources including imports and exports. Another console sets limits on imports and exports as well as setting their price.

Since Montana is a coal-producing state, one console controls energy conversion needed to meet demands. Coal may be converted to liquid or gaseous fuels; the generation of electricity is possible using either fossil fuels or nuclear and hydroelectric sources. Another panel holds the production capability of fossil fuel resources. One control console, operated only by the demonstrator of the simulator, sets limits on the various world and national scenarios of import and export possibilities tying Montana to the rest of the world.

Future developments of the demonstrator of the simulator will be a certain scenario of "outside" possibilities. Participants will have that as a "given" until changed to another scenario, again with factors that are controlled outside of the state. The control panel will allow an input of limitations and ties of Montana to the rest of the world.

The Regional Simulator also has time lags programmed for the building of energy production and conversion facilities, a factor the more general National Simulator couldn't take into consideration. The time lags require the modeling of production facilities before energy can be produced and used.

The regional installation allows for a more extensive look at conversion of resources such as conversion of coal to gaseous and liquid fuels. Special routines provide for complete fuel mixes available to the various demand sectors rather than just the chemical/electric mixes used in the National Simulator.

Another key difference is that the Regional Simulator is set up on a 25- to 50-year basis, whereas the national model projects up to 1,000 years. But time is not a determining factor. The programmers are aware that the situation changes with such rapidity that after the first 10 to 20 years, all is speculation anyway.

Dr. Amend (left) with participants during a simulation session at Kellog Extension Education Conference in Montana.

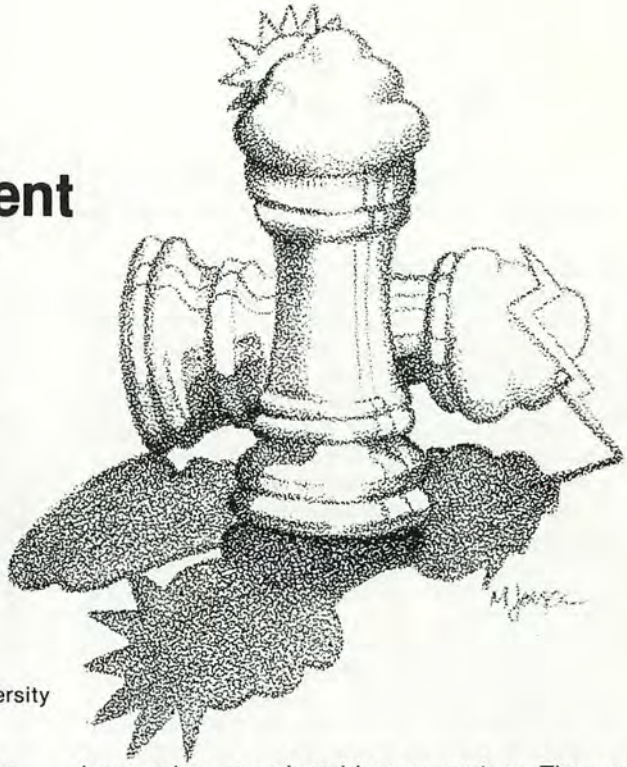
Like its parent, the regional model has a system of warning devices. When there is an imbalance of supply and demand, or when environmental conditions exceed programmed limitations, an alarm will go off in the appropriate console. It's not the world or country that's in trouble this time, but the State of Montana. The machine said "tilt" and something must be done to put the state energy situation back into equilibrium. Knobs must be adjusted. Is it to be increased environmental pollution or decreased energy demand? If it's to be decreased demand, what areas are to suffer? Or is there a less-polluting way to produce energy? How long will it take? Do we have the time and money to invest in research and development of a new process?

As in life, decisions must be made. The simulator is serving as a useful tool for both professionals and public to acquaint themselves with the environment's plea against overwork, and in the last analysis it is the citizens' choice through their elected officials whether to heed that plea or to ignore it. Computer hobbyists are in a privileged position in that regard for they have learned how to manipulate data and to derive answers. They can work in a make-believe universe or in our own real world.

Persons or groups interested in this program may obtain further information by contacting Dr. Burrell Wood, Office of Public Affairs, U.S. ERDA, Washington, DC 20545.

The Energy/Environment Simulator

Interactive Simulation



By John R. Amend
Professor of Chemistry, Montana State University

A number of important problems face our nation today. Solutions to several of these problems demand the common thread of knowledgeable action by the public and their elected representatives. This action must take place within a system whose variables are governed by laws of science, but which are not well understood by the general populace. The problem of energy is a prominent example — how can our nation preserve a reasonable standard of living, maintain a reasonable level of environmental pollution, and save part of our non-renewable energy resources for future generations? The solution to this problem is partly technological, in terms of development of new energy resources and of better utilization of our present resources, and partly educational. Decisions concerning conservation, energy conversion, and resource utilization are ultimately personal or legislative decisions made not by the scientist, engineer, or technical manager, but by the man on the street and his elected representatives. How, then, can we insure that this person is aware that a problem exists and has a reasonable understanding of the major variables involved in the system?

In the previous article, Joan Melcher described some of our work in the area of interactive simulation. This technique places people in a decision-making situation involving real variables and alternatives, projects for them the probable consequences of their policies or strategies, and has proven extremely effective as a tool for public education. In this article I will discuss briefly the general idea of interactive modeling, and will describe the electronic implementation of the energy model described in Ms. Melcher's article.

Figure 1 presents a generalized model for interactive simulation. This model consists of four sectors superimposed on a real problem or system. The goal of the simulation is simply to optimize the system's operation. If the variables and situation are real, there is a good chance that the participants will see their decision-making process as having implications far beyond the simulation.

The simulation is begun by defining the "optimum" system operating conditions. Decisions in this sector are made by the participants, and are usually subjective and moral in character. In the case of the Energy/Environment Simulator, these "optimum" conditions usually involve maintenance of a reasonable standard of living, a reasonable standard of environmental pollution and preservation of some of our non-renewable resources for future generations.

Operation of the system is controlled by a number of variables accessible to the participants through a group of "lap unit" control consoles. These variables are representative of the major variables governing the real system, and are usually defined in *more-than/less-than* terms as compared to the current condition. In general, a lay audience does not assimilate quantitative information well. The points may be made as well, and usually understood more quickly, in terms of *more-than/less-than* judgements as compared to the current situation. Variables are, however, real and quantitative in their action if not their knob calibration.

System simulation is provided by a computation circuit that responds to input variables in the same manner as the system under study. There are a number of ways to provide this simulation, ranging from simple analog operational amplifier circuits to microprocessors and minicomputers. These approaches differ in stability, accuracy, response time, design time, and cost. The im-

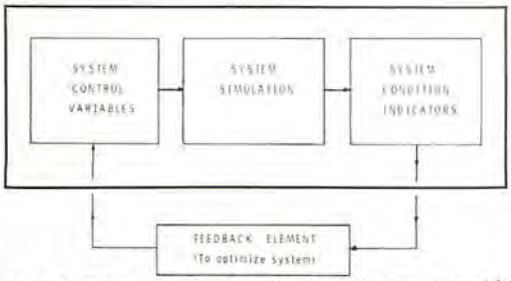


Figure 1. Our model for interactive simulation consists of four sectors superimposed on a real problem or system. The goal of the simulation is simply to optimize the system's operating condition. Learning takes place as participants interact with the input variables and observe their effect on the system's overall condition. The simulator poses problems to the participants, acts according to their decisions, and forces them to live with the consequences of these decisions as time progresses. Participants often change their ideas of what is "optimum" after being faced with the realities of the system.

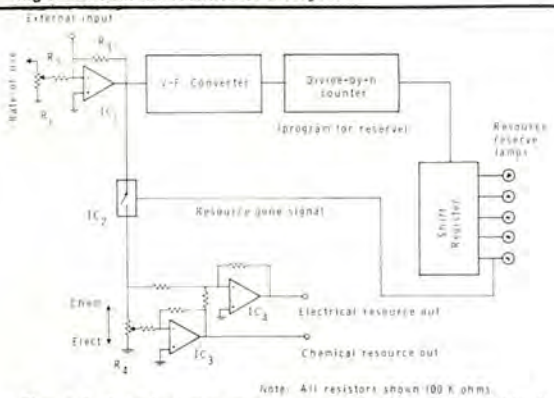


Figure 3. A typical resource integrator is illustrated in block form in this figure. The rate-of-use signal is digitized by the voltage-to-frequency converter, divided by a programmable counter, and accumulated in a shift register. When the shift register is full, the resource is exhausted. The amount of resource available is determined by the division factor of the divide-by-n counter. Amplifiers IC_3 and IC_4 and potentiometer R_4 form a continuously variable distribution circuit to distribute the rate-of-use signal to the chemical and electrical energy pools.

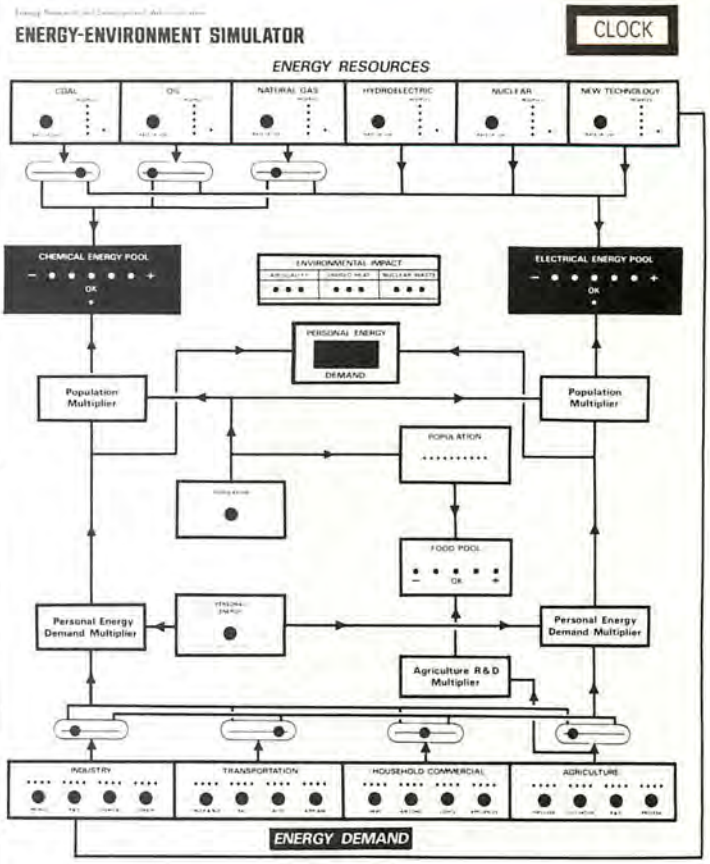


Figure 2. The information flow through the Energy/Environment Simulator's model is illustrated in this figure.

portant constraint on the computation circuit is that is must respond as the system responds, within the accuracy of the input data. It is not necessary to make a ±0.1% computation with ±10% data. The first National Energy/Environment Simulator, designed by the author in 1973, was entirely analog in its computational circuitry. Addition, subtraction, and comparison are accomplished by analog circuits, while integration, multiplication, and counting functions utilize digital circuits for stability. This simulator uses about 200 IC's, about 76 of which are involved in computation. The remainder are used for I/O and display drive. A microprocessor based Energy/Environment Simulator is currently being completed under ERDA sponsorship by Dr. Jan Narud's group as Los Alamos Scientific Laboratory. This unit is based on an 8080 microprocessor and uses about 4K of memory.

The condition of the system is indicated by three types of displays: *more-than/less-than*, as in the case of the red(-) - amber - green - amber - blue (+) pool balance indicators; semi-quantitative as represented by the strings of light-emitting diodes used as resource remaining and energy demand indicators, and quantitative, as represented by the 4-digit clock display and 3-digit personal energy demand display. Digital readouts are reserved for areas in which a) it is important that a quantitative value be presented; b) the display units are understandable to the audience; and/or c) small changes must be observed in a large number. About 176 binary display elements are used to display the system conditions; a major fraction of the cost of the instrument is in displays, latches, and display drivers. Both the microprocessor and hybrid versions of the simulator use more IC's for I/O than for computation.

The feedback element is a decision-making element which inputs system condition information and outputs input variable modification instructions. The participants are the feedback element in the simulation. They receive system condition information from the display, and output control information to the input circuits. Criteria for decision are the initially-decided upon optimum system operating conditions.

The simulation differs from standard digital computer simulations in that it operates in "real time" (100 clock years per minute, for example), and presents information concerning all of its variables simultaneously during the run. The group conducting the simulation may interact with the model at any time during the run, changing variables to optimize their situation. After observing the result of a given simulation, participants can discuss the strong and weak points of their strategy or energy policy, modify the strategy, press the reset button, and try the new strategy.

The information flow through the Energy/Environment Simulator's model is illustrated in Figure 2. The operation of each of the principal functional blocks comprising this model is described in the following paragraphs.

The fossil and nuclear resource integrators (Figure 3) are identical except for programmed reserve. IC_1 is a summing amplifier which sums the "rate-of-use" inputs from the simulator panel (R_1) and the external control consoles. The output of this amplifier drives a voltage-to-frequency converter (discussed later in this paragraph) and the chemical/electrical distribution amplifier through electronic switch IC_2. The distribution amplifier IC_3-IC_4 distributes the rate-of-use signal to the two energy pools. The output of the chemical pool amplifier (IC_4, gain = -1) may range from zero to the maximum

rate-of-use signal, depending upon the setting of distribution potentiometer R_4. When the slider of R_4 is at the ground end of the potentiometer, there is no output from IC_3. IC_4 then acts as a simple inverting amplifier, outputting a signal equal to the rate-of-use signal but reversed in sign. However, as the slider of R_4 is moved up from ground, IC_3 will output an inverted signal equal to the fractional part of the rate-of-use signal selected by potentiometer R_4. This inverted signal is also applied to the summing input of IC_4, thus reducing the output of the electrical pool amplifier IC_4 by an amount equal to the output of chemical pool amplifier IC_3. Chemical pool output plus electrical pool output always equals the rate-of-use signal. The chemical and electrical outputs sum with like outputs from other resource modules.

The amount of resource remaining is determined by a digital integrator composed of the voltage-to-frequency converter, the programmable divide by n counter, and the shift register. The V-F converter produces a digital pulse train of frequency proportional to the rate-of-use signal. This pulse train is divided by the programmable divide-by-n counter, which then drives a 5-bit shift register. As pulses from the counter are sent into the shift register clock input, 0's are shifted into the register, the resource lamps go out one-by-one, and finally when the last resource lamp is extinguished electronic switch IC_2 opens disconnecting the resource. This circuit permits full resource use until the resource is gone; a decreasing maximum rate-of-use may be obtained by driving the rate-of-use pot with a summing amplifier driven from the five shift register outputs. In this configuration, the maximum possible rate of use of the resource will decrease as the reserve is depleted, falling to zero at exhaustion. (Such a circuit is used in the New Technology Resource; 1's are shifted into the register and the available output signal increases in proportion to the accumulated R & D signal.)

Environmental impact is computed (Figure 4) by summing the several rate-of-use signals through weighting resistors proportional to each resource's contribution to that pollution pool. For example, coal and oil contribute to the air quality circuit, all resources except hydroelectric contribute to the unused heat circuit, and the nuclear resource contributes to the nuclear waste circuit. Summing of these inputs is accomplished by IC_1. IC's 2 and 3 form a three-level comparator switching at approximately 1 volt (green to amber) and 2 volts (amber to red); IC's 4 and 5 form an exclusive OR logic circuit to drive the green and amber indicator lamps, while IC's 6 and 7 cause the red warning lamp to flash when the summed pollution signal is greater than 2 volts.

A portion of a typical demand module is shown in Figure 5. IC_1 is a summing amplifier which sums the front-panel demand signal (R_1) and the signal from the external control consoles. This amplifier drives a second summing amplifier (IC_3) through a 4-bit binary resistor demand weighting circuit; the output of IC_3 drives a chemical/electrical distribution amplifier identical to that described in the discussion of the resource circuit. Inverting amplifier IC_2 inverts the demand signal and drives a 4-step comparator composed of a 3302 comparator and 4 LED's. The 4-LED strong above each demand knob shows the relative rate-of-use of that demand sector. The weighting switch permits the unit to be adjusted so that the 12-0'clock position of each demand potentiometer is representative of the "current" demand level. Each demand module consists of four summing amplifiers, four inverting amplifiers, and four 4-LED display comparators.

Population and personal energy demand multipliers are simply amplifiers with digitally-controlled gain. In the circuit shown in Figure 6, IC_1 is a summing amplifier that sums all demands into that pool. The gain of IC_2 is simply R_3/R_2, and is set to 1.0. However, as counts are accumulated in the growth scaler, resistors R_4-R_7 are switched in parallel with R_2, thus reducing the amplifier input resistance and increasing the gain. The values of resistors R_4-R_7 are coded in a binary 1-2-4-8 sequence, giving an increasing gain in 15 equal steps. The current simulator actually uses an 8-bit (256 step) counter and an 8-resistor network, but the effect is only to give smaller growth steps. If two of these growth circuits are cascaded and driven by the same clock signal, the output is equal to $(\text{input})(\text{gain})^2$. This function is a reasonable approach to exponential growth, and serves well to illustrate the problem encountered with increasing rate-of-change of energy use.

The energy modules sum the demand and resource signals, and compute the relative balance between these two signals. Identical pool circuits (Figure 7) are used for chemical, electrical, and food pools. Demand signals are summed by amplifier IC_1 (these signals come from the growth module), resource signals are summed by amplifier IC_2. The summed demand and resource signals are then added in amplifier IC_3, which drives a 5-level comparator circuit formed of IC's 4-13. Each of the comparator steps is about 0.46 volts above the previous step; the pool balance potentiometer R_1 permits setting the output of IC_3 to about 1.15 volts for a "green" balance condition when demands equal resources.

SUMMARY

Interactive simulation has proven to be an extremely time-efficient and relatively inexpensive means of communicating the structure of a complex problem area to a lay audience. One of the principal values of this technique is its ability to place people in a decision-making situation involving real problems and alternatives. Interactive simulation, if honestly modeled, does not present a certain point of view but instead offers participants an opportunity to experiment with different strategies and policies, and to observe the probable consequences of their actions. If the variables and situations are real, there is a good chance that the participant will see his decision-making process as having implications far beyond the simulation. Although the examples presented in this article were drawn from the work we have done in the problem area of energy, the general approach has application in any dynamic system of general interest that can be immediately modeled.

A project of this magnitude is seldom the work of one person. Donald Frame and Bruce Ivey contributed to the electronic design of the simulator illustrated in this article, Anita Armold provided technical back-up, and Fred Sanford of the MSU Office of Information provided the graphics. Burrell Wood of ERDA contributed to the model definition, and Lyle Wilhelmi and Bryan Valett contributed to the panel design. The model for all generations of the national simulator has been based on energy flow models presented by Kenneth F. Weaver in the *National Geographic*[1] and by Earl Cook in *Scientific American*[2]. The regional energy simulator discussed in Joan Melcher's article was developed by Donald Brelsford and Byron Jones of the Montana Energy and MHD Research and Development Institute and Anita Armold and the author of Montana State University. Harold Wehrman provided technical back-up, and Fred Sanford again provided the graphics.

REFERENCES

1. Kenneth F. Weaver, "The Search for Tomorrow's Power," *National Geographic,* November 1972, Volume 142, #3.
2. Earl Cook, "The Flow of Energy in an Industrial Society," *Scientific American,* September 1971, Volume 224, #3.

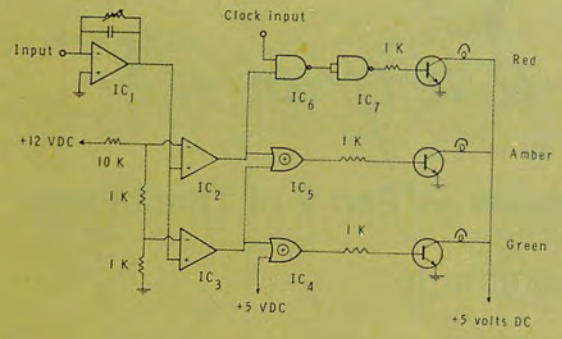


Figure 4. A typical environmental impact circuit is illustrated in this figure. Three such circuits are used in the simulator; air quality, unused heat, and nuclear waste. Each circuit is driven by the summed rate-of-use signals of the resources, weighted according to their contribution to that particular environmental impact.

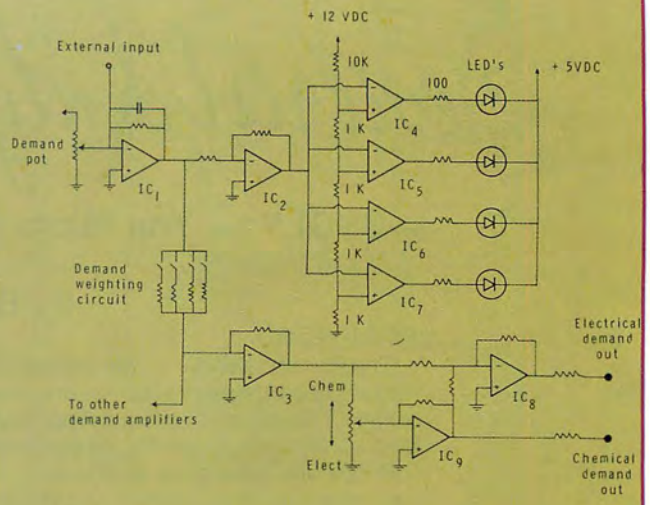


Figure 5. A portion of a demand module is illustrated in this figure. Each demand module (industry, transportation, household/commercial utility, and agriculture) consists of four demand potentiometers, four rate-of-demand indicators, and a distribution amplifier.

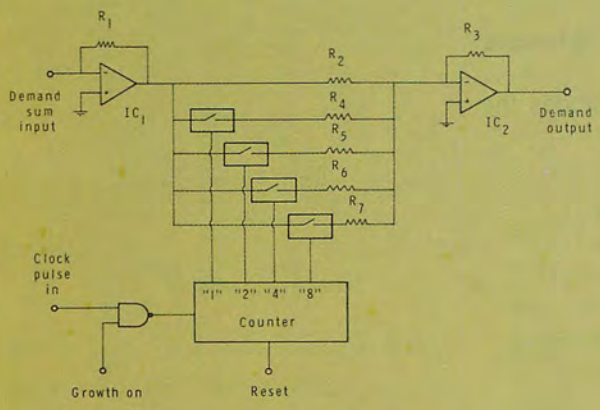


Figure 6. This figure illustrates a simplified growth circuit. The demand signals are summed by IC_1, the gain of amplifier IC_2 is determined by the accumulated count in the counter and the values of the binary-coded resistor group R_4-R_7.

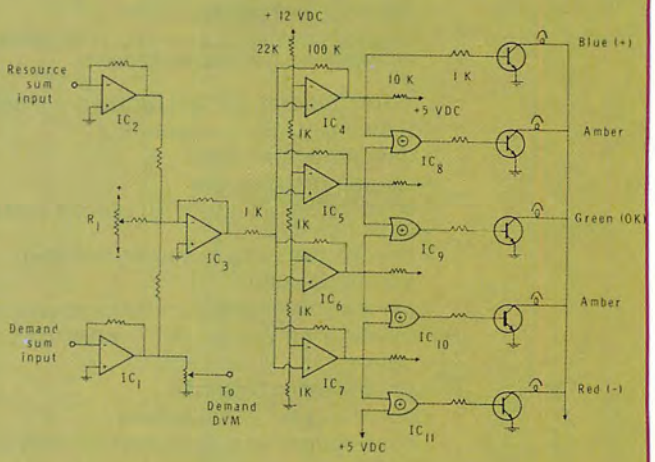


Figure 7. The circuit of an energy pool module is illustrated in this figure. This circuit sums resource and demand signals, computes the relative balance between these signals, and presents this balance as a five-step read-out — red (-), amber, green (OK), amber, blue (+).

General Ledger Program

—BSGLP — The Micro Bookmaker — Part 2 of Three Parts

by Bud Shamburger

FOREWORD

The General Ledger is the second of a series of software features on business application programs by Bud Shamburger. This second article covers a Motel General Ledger Software Package developed by the author for his 78-unit Ramada Inn. Because of its size, the General Ledger Package will be published in the following three parts:

- GENERAL LEDGER PACKAGE DESCRIPTION & PROCEDURES
- GENERAL LEDGER PACKAGE OUTPUT EXAMPLES
- GENERAL LEDGER PACKAGE BASIC PROGRAMS

Part 1 covered the description of the General Ledger Program, Part 2 covers the operating procedures and sample outputs, while Part 3 will list the General Ledger programs.

The General Ledger outputs include the following:

- MONTHLY BANK STATEMENT
- GENERAL JOURNAL
- BALANCE SHEET & OPERATING STATEMENT
- MONTHLY BUDGET
- YTD BUDGET
- MONTHLY STATISTICAL REPORT
- YTD STATISTICAL REPORT
- YEAR TO YEAR INCOME & EXPENSE COMPARISONS
- AVERAGE DAILY ROOM RATES MONTHLY & YTD
- OCCUPANCY RATES MONTHLY & YTD
- CASH FLOW ANALYSIS
- SPECIAL SORT PROGRAM WHICH REARRANGES THE DATA FILES TO PRODUCE THE ABOVE REPORTS

The General Ledger Software Package includes the following BASIC programs:

- CHECK TRANSACTIONS
- LEDGER TRANSACTION
- MERGE BANK BACKUP WITH LEDGER & CREATE NEW BANK CURRENT
- CHECKS CASHED & TAG BANK CURRENT
- BANK STATEMENT
- DAILY ROOM REVENUE JOURNAL VOUCHERS
- MONTHLY OR YTD BUDGET — MONTHLY OR YTD ANALYSIS
- COPY FILES
- MAKE MASTER CHANGES
- SORT GENERAL LEDGER FILES
- COPY BUDGET FILE TO BUDGET HISTORY FILE
- LOADS IN GENERAL LEDGER CHART OF ACCOUNTS
- LIST THE PROCEDURES FOR RUNNING THE GENERAL LEDGER PACKAGE OF PROGRAMS
- DISPLAY ALL GENERAL LEDGER PROGRAMS AND PROMPTS THE OPERATOR AS TO THE FLOW OF PROCESSING

The author's microcomputer hardware system configuration includes:

- MITS ALTAIR™ 8080B MICROCOMPUTER WITH 64K MEMORY, 4 SIO PORTS, 2 PIO PORTS & PROM BOOTSTRAP LOADER
- TWO MITS ALTAIR™ HARD SECTORED FLOPPY DISC DRIVES
- TWO ADM3 VIDEO TERMINALS
- ONE OKIDATA 110 LINE PRINTER
- ONE MPI LINE PRINTER
- MITS 12K DISC BASIC VER. 4.0

Now to Bud's General Ledger Software Package.

—Software Editor

SUMMARY OF PROCEDURE STEPS

Procedure steps consist of the following monthly and year end procedures:

MONTHLY PROCEDURE

PROGRAM	STEP	PROCEDURE
GLMENU	0.	Display all general ledger programs and prompts the operator as to the flow of processing. In addition this program boots up the desired program selected by the operator.
GL6	1.	Enter daily room revenue journal vouchers
GL1	2.	Enter check transactions for account number 1110 — the general checking account
GL1	3.	Enter journal vouchers for: A. Other income (concessions, rent, etc.) B. Bank charges (returned checks, BAC & MC, etc.) C. Add new account headers (zero money amounts)
COPRAN	4.	Copy 'ledger' current to 'ledger' backup-before
SORTGL	5.	Sort on check number/voucher number
GL2	6.	Run check/voucher register — verify debits = credits
COPRAN	7.	Copy 'BANKCURR' to 'BANKBKUP'
GL3	8.	Merge-drive 1 BANKBKUP- with -drive 0 ledger account 1110- and cut new -drive 1 BANKCURR-
COPRAN	9.	Copy 'BANKCURR' (0201-0400) to 'BANKSAVE' (0401-0600)
GL4	10.	Enter check number and amount from canceled checks and tag checks cashed in 'BANKCURR' (Enter 'T' to terminate input)
GL5 COPRAN	11.	Run bank statement for account 1110 and balance to bank. Make any corrections to 'ledger' & copy to 'ledger' backup-before
SORTGL	12.	Sort 'ledger' on acct#/check#/ voucher#
GL2	13.	Run general journal. Verify bank balances. Look over run for errors. Correct any errors and rerun if necessary
GL2	14.	Run balance sheet & operating statement
GL7	15.	Run monthly budget
GL7	16.	Run Y.T.D. budget
GL7	17.	Run monthly statistical report
GL7	18.	Run Y.T.D. statistical report
COPRAN	19.	Copy 'ledger' current to 'ledger' backup-after
COPCON	20.	Copy 'budget' to 'BGTMOYR'

YEAR END PROCEDURE

GL2	1.	After all entries and runs for the year have been made, request closing entries, place new floppy on drive 0 and run general journal with no transactions. All the proper accounts will be zeroed out. Manually add current earnings total (account #3096) to undistributed taxable income (account #3001) to place the balance sheet back in balance.
	2.	Enter new budget figures into data tables in program 'GL7'.
	3.	Make journal entry to establish new current liabilities—notes payable account 2133.
	4.	Accrue accounts payable at year end and journalize. Take out of accounts payable as paid.
	5.	Run year end balance sheet and operating statement.

Monthly Step #0 — Boot Up GLMENU And Proceed

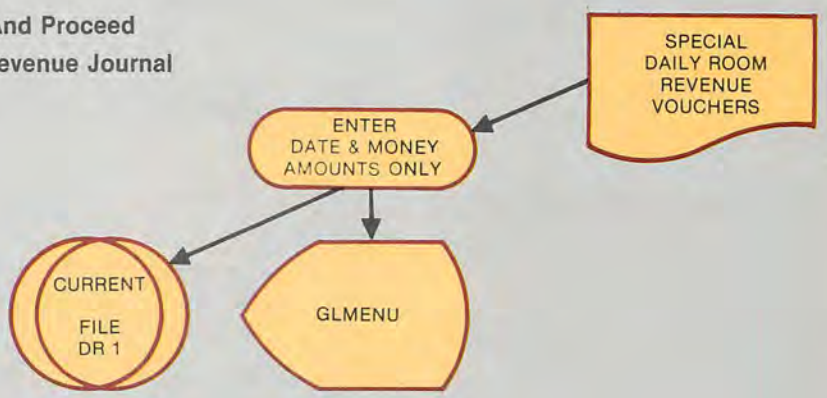
Monthly Step #1 — Enter Daily Room Revenue Journal Vouchers

FLOW DIAGRAM

STEP 1

PROGRAM "GL6"

CURRENT GENERAL "LEDGER" FILE DR 1



Sample of Terminal Inquiry Routines Step 1 Program GL6

```
ENTER -Y- TO MOUNT THE FILE? Y
GENERAL LEDGER TRANSACTIONS

DAILY DEPOSIT VOUCHERS
ENTER TRANSACTION MO-DY-YR? 05-01-77
ENTER -N- FOR NO TRANSACTION
ENTER -DONE- TO STOP
 TRANS ACCT VOCHR                AMOUNT
MODYYR NMBR NUMBR DESCRIPTION    $$$$$$.##
060177 1110 V0601 BANK DEPOSIT

(YOU MUST KEY IN DECIMAL POINTS APPEARING TO THE RIGHT OF ALL DIGITS)
```

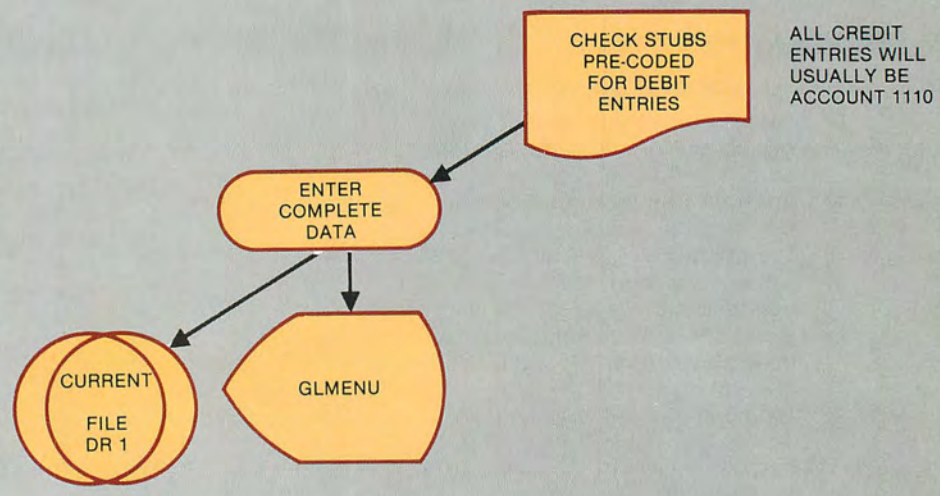
Monthly Step #2 — Enter Check Transactions for General Checking Account

FLOW DIAGRAM

STEP 2

PROGRAM "GL1"

CURRENT GENERAL "LEDGER" FILE DR 1



Sample of Terminal Inquiry Routines Step 2 Program GL1

```
ENTER -Y- TO MOUNT THE FILE? Y
ENTER GENERAL LEDGER TRANSACTIONS

ENTER -1- FOR HEADERS & BAL FWDS
ENTER -2- FOR CHECK TRANSACTIONS
ENTER -3- FOR VOUCHER TRANSACTIONS
? 2
ENTER -U- FOR UNBALANCED ENTRIES? N
ENTER TRANSACTION MO & YR AS MOYR? 0577
100 ENTRIES MAX PER CHECK OR VOUCHER
ENTER -T- TO TOTAL TRANSACTIONS
-L- FOR LAST TRANSACTION
   TRANS ACCT C/V                    AMOUNT
  MODYYR NUMB NUMB DESCRIPTION . . -$$$,$$$.$$
?
(YOU MUST KEY IN DECIMAL POINTS APPEARING TO THE RIGHT OF ALL DIGITS)
```

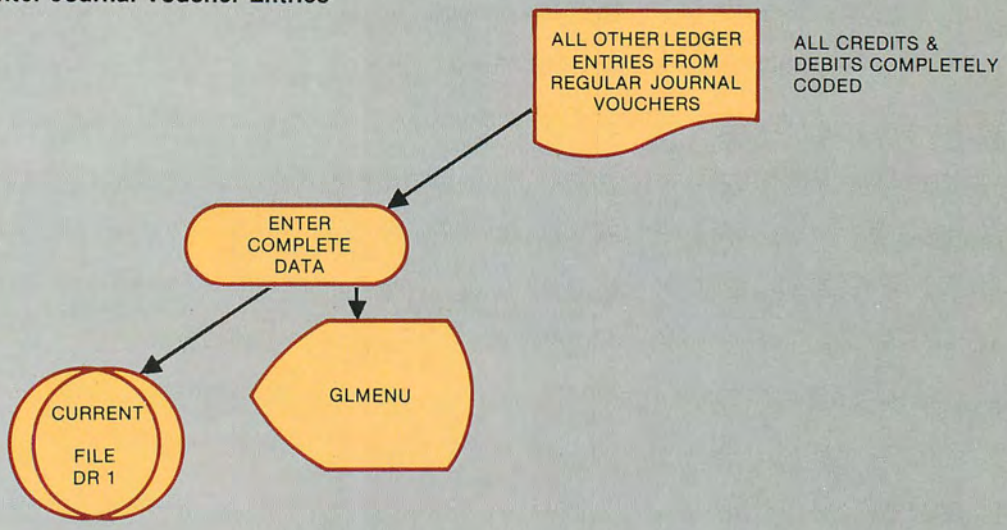
Monthly Step #3 — Enter Journal Voucher Entries

FLOW DIAGRAM

STEP 3

PROGRAM "GL1"

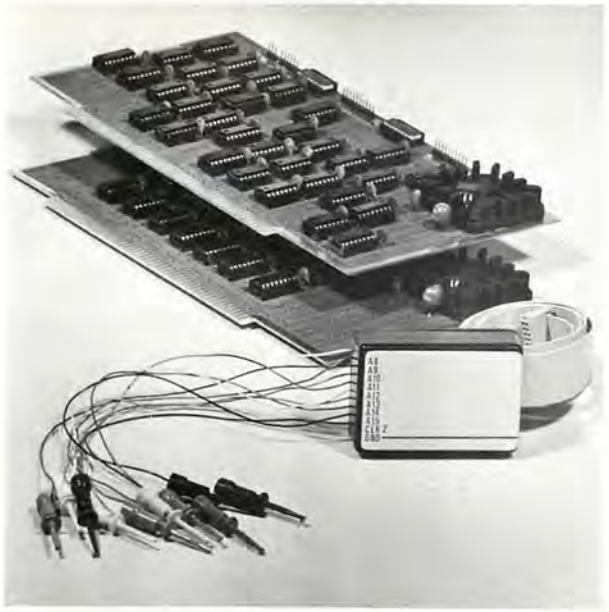
CURRENT GENERAL "LEDGER" FILE DR 1



Sample of Terminal Inquiry Routines Step 3 Program GL1

```
ENTER -Y- TO MOUNT THE FILE? Y
ENTER GENERAL LEDGER TRANSACTIONS

ENTER -1- FOR HEADERS & BAL FWDS
ENTER -2- FOR CHECK TRANSACTIONS
ENTER -3- FOR VOUCHER TRANSACTIONS
? 3  (ENTER A 1 HERE TO ADD HEADERS FOR NEW ACCOUNTS AMOUNT 0)
ENTER -U- FOR UNBALANCED ENTRIES? N (USED TO CORRECT A DISK ERROR)
ENTER TRANSACTION MO & YR AS MOYR? 0577
100 ENTRIES MAX PER CHECK OR VOUCHER
ENTER -T- TO TOTAL TRANSACTIONS
ENTER -L- FOR LAST TRANSACTION (TO REQUEST FOR DATA)
   TRANS ACCT C/V                    AMOUNT
  MODYYR NUMB NUMB DESCRIPTION . . -$$$,$$$.$$
?
(YOU MUST KEY IN DECIMAL POINTS APPEARING TO THE RIGHT OF ALL DIGITS)
```



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24 channel Logic Analzer plugs into your S-100 Bus

Features

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- Display of disassembled program flow.
- Dual mode operation — external mode analyses any external logic system. Internal mode monitors users data and address bus.
- Selectable trigger point anywhere in the 256 samples.
- 0-16 bit trigger word format or external qualifier.
- 10MHz sample rate (50ns min. pulse width)
- Synchronous clock sample with coincident or delayed clock mode.
- User defined reference memory.
- Displays and system control through keyboard entry.
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Display of disassembled program flow.

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The Databyte Logic Analyzer (DATALYZER) is a convenient, flexible, high quality device. Efficient engineering has allowed a combination of features previously available in only the most expensive units.

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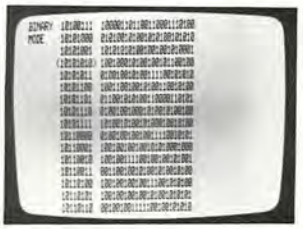

Displays in Binary

Please send me the 24 Channel **LOGIC ANALYZER**

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Number _____

Signature _____

Databyte, Inc.

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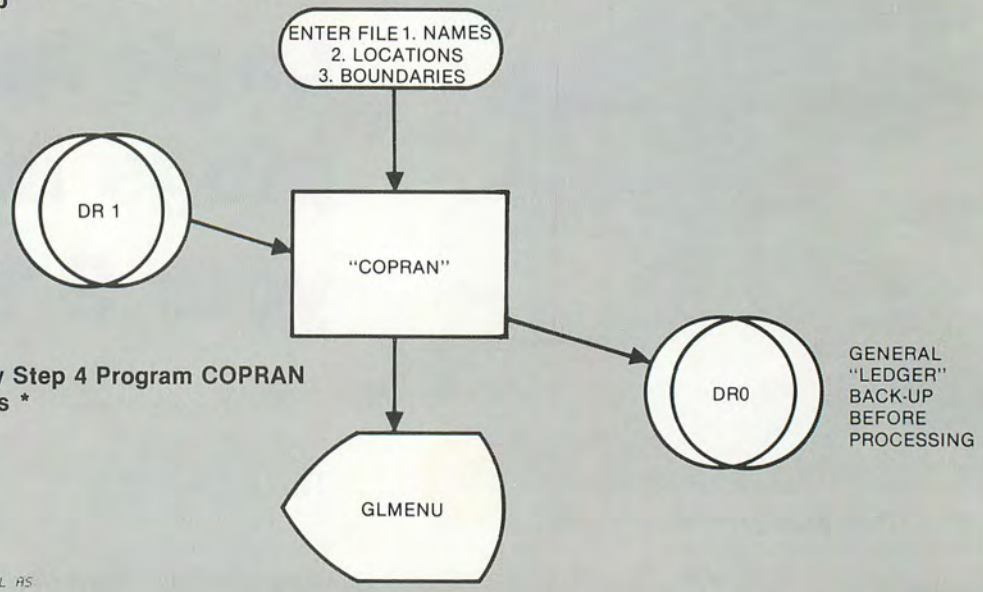
7433 Hubbard Avenue
Middleton, Wisconsin 53562
Tel: (608) 831-7666

CIRCLE INQUIRY NO. 7

Monthly Step #4 — Copy Ledger Current to Ledger Backup

FLOW DIAGRAM



STEP 4

PROGRAM "COPRAN"

CURRENT
GENERAL
"LEDGER"
FILE

REPEAT THIS STEP
FOR RECORD #2037

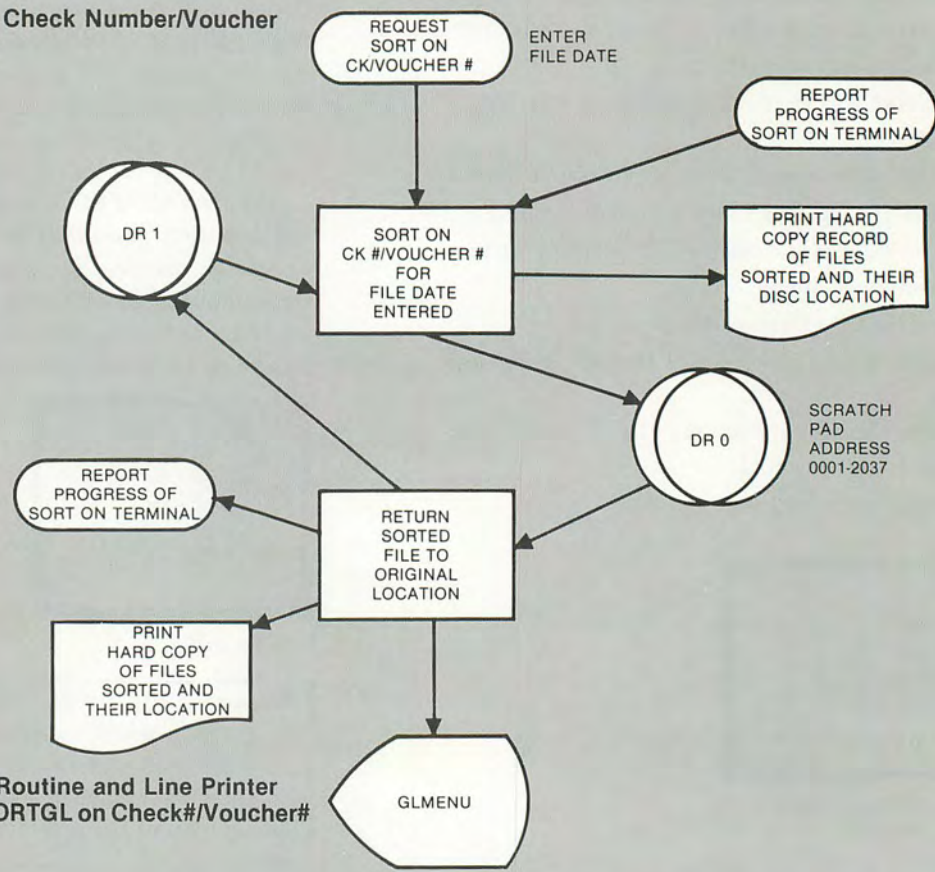
Sample of Terminal Inquiry Step 4 Program COPRAN Copy * Basic-Random-Files *

```
ENTER -INPUT- FILE NAME? LEDGER
ENTER -OUTPUT-FILE NAME? LEDGER
ENTER -INPUT-DR#? 1
ENTER -OUTPUT- DR#? 0
ENTER -INPUT- BEG REC#? 1201
ENTER -INPUT- END REC#? 1315
ENTER -OUTPUT-BEG REC#? 1
ENTER -OUTPUT- END REC#? 115
TO MOUNT THE FILES ENTER -Y-? N

THE COPY IS MONITORED ON THE TERMINAL AS
DR#       REC#
 1        1201
 0           1
 1        1202
 0           2
 0
   ETC
```

Monthly Step #5 — Sort On Check Number/Voucher Number

FLOW DIAGRAM



STEP 5

PROGRAM "SORTGL"

CURRENT
GENERAL
"LEDGER"
FILE
DR 1

Sample of Terminal Inquiry Routine and Line Printer Output Off Step 5 Program SORTGL on Check#/Voucher#

```
ENTER 'Y' TO MOUNT THE FILES? N
GENERAL LEDGER SORT
ENTER -A- TO SORT ON ACCT#/CK#/VCH#
ENTER -C- TO SORT ON CK/VCH #? C
ENTER DATE TO BE SORTED AS MOYR? 0577

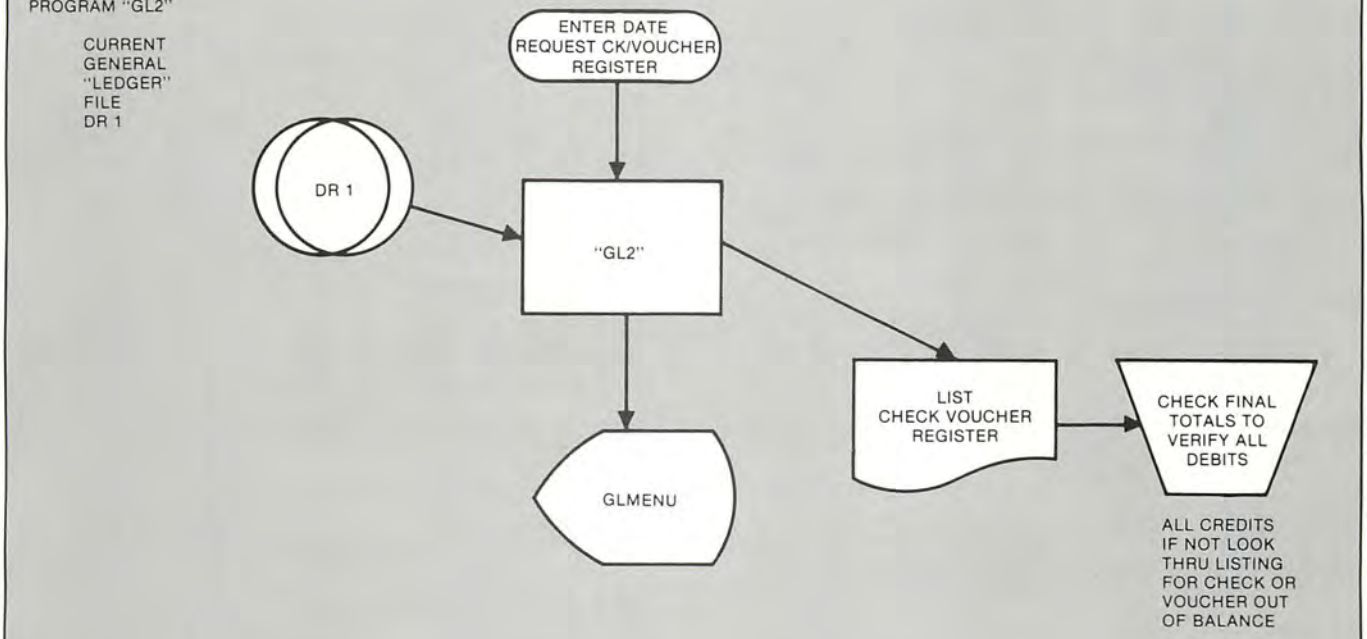

(LINE PRINTER HARD COPY RECORD OF SORT)
GEN LEDGER SORT ON CK#/VCH#
DATE 0577
TOTAL RECORDS  343  FREE MEMORY 17092

ENTERING OUTPUT ROUTINE DR 0
** EOF ** DR 0 IN OUTPUT SECTOR 115  RECORD #   1

ENTERING COPY-BACK ROUTINE
DR 1 FIRST OUTPUT SECTOR 1201  RECORD #   1
** EOF ** DR 1 IN OUTPUT SECTOR 1315 RECORD #   1
EOJ
```

Monthly Step #6 — Run Check/Voucher Register — Verify Debits = Credits

FLOW DIAGRAM



Terminal Inquiry Routines

```
TO MOUNT THE FILE ENTER -Y-? N
GENERAL LEDGER
ENTER PERIOD ENDING DATE AS MO-DY-YR? 05-31-77
ENTER -Y- IF YOU WANT CLOSING ENTRIES? N
ENTER -SR- TO TABULATE AN ACCOUNT NUMBER? N
ENTER -T- FOR TRB, -L- FOR LIST? L
     ** ENTER **
1-FOR CTL ON CK OR VUCH#
2-FOR CTL ON ACCOUNT #
? 1
```

Sample of Ck/Voucher Register Step 6 Program GL2

CONWAY R I INC , CONWAY ARK

CHECK/VOUCHER REGISTER - PERIOD ENDING 05-31-77 PAGE 1

DATE MO DY YR	ACCT NUMB	CNUMB VNUMB	DESCRIPTION	MONTHLY DEBITS	MONTHLY CREDITS	Y T D BALANCE
05-03-77	1110	C0912	KORDSMEIR PLUMB		2,151.38-	2,151.38-
05-03-77	7611	C0912	KORDSMEIR PLUMB	2,151.38		2,151.38
			ACCOUNT TOTAL	2,151.38	2,151.38-	0.00
05-05-77	1110	C0913	AW HALTER		350.00-	350.00-
05-05-77	7403	C0913	AW HALTER	350.00		350.00
			ACCOUNT TOTAL	350.00	350.00-	0.00
05-05-77	1110	C0914	R HALTER		100.00-	100.00-
05-05-77	7403	C0914	R HALTER	100.00		100.00
			ACCOUNT TOTAL	100.00	100.00-	0.00
05-05-77	1110	C0915	FW HALTER EST		350.00-	350.00-
05-05-77	7403	C0915	FW HALTER EST	350.00		350.00
			ACCOUNT TOTAL	350.00	350.00-	0.00
05-05-77	7411	C0916	JD SHAMBURGER	200.00		200.00
05-05-77	1110	C0916	JD SHAMBURGER		200.00-	200.00-
			ACCOUNT TOTAL	200.00	200.00-	0.00
05-01-77	2200	C0917	MODERN SEC LIFE	1,614.81		1,614.81
05-01-77	1110	C0917	MODERN SEC LIFE		10,711.75-	10,711.75-
05-01-77	7408	C0917	MODERN SEC LIFE	9,096.94		9,096.94
			ACCOUNT TOTAL	10,711.75	10,711.75-	0.00
05-06-77	7600	C0918	ERVIN EBSEN	49.45		49.45
05-06-77	1110	C0918	ERVIN EBSEN		49.45-	49.45-
			ACCOUNT TOTAL	49.45	49.45-	0.00
05-06-77	1110	C0919	ROB SHAMBURGER		30.00-	30.00-
05-06-77	7601	C0919	ROB SHAMBURGER	30.00		30.00
			ACCOUNT TOTAL	30.00	30.00-	0.00
05-06-77	1110	C0920	PAYROLL ACCT		1,747.89-	1,747.89-
05-06-77	1111	C0920	PAYROLL ACCT	1,747.89		1,747.89
			ACCOUNT TOTAL	1,747.89	1,747.89-	0.00
05-06-77	1110	C0921	BOWENS REST		1,194.44-	1,194.44-
05-06-77	2134	C0921	BOWENS REST	1,194.44		1,194.44
			ACCOUNT TOTAL	1,194.44	1,194.44-	0.00
05-11-77	1110	C0922	RAMADA INNS		919.05-	919.05-
05-11-77	7501	C0922	RAMADA INNS	308.10		308.10
05-11-77	7409	C0922	RAMADA INNS	587.55		587.55
05-11-77	7417	C0922	RAMADA INNS	23.40		23.40
			ACCOUNT TOTAL	919.05	919.05-	0.00-
05-12-77	1110	C0923	ROB SHAMBURGER		15.00-	15.00-
05-12-77	7601	C0923	ROB SHAMBURGER	15.00		15.00

CONWAY R I INC , CONWAY ARK

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DATE MO DY YR	ACCT NUMB	CNUMB VNUMB	DESCRIPTION	MONTHLY DEBITS	MONTHLY CREDITS	Y T D BALANCE
			ACCOUNT TOTAL	15.00	15.00-	0.00
05-12-77	1111	C0924	PAYROLL ACCT	3,395.28		3,395.28
05-12-77	1110	C0924	PAYROLL ACCT		3,395.28-	3,395.28-
			ACCOUNT TOTAL	3,395.28	3,395.28-	0.00
05-12-77	7600	C0925	ERVIN EBSEN	51.75		51.75
05-12-77	1110	C0925	ERVIN EBSEN		51.75-	51.75-
			ACCOUNT TOTAL	51.75	51.75-	0.00
05-16-77	7112	C0926	IMP TRAVL SERV	16.80		16.80
05-16-77	1110	C0926	IMP TRAVL SERV		16.80-	16.80-
			ACCOUNT TOTAL	16.80	16.80-	0.00
05-18-77	1110	C0927	LAWRENCE CARTER		70.00-	70.00-
05-18-77	7116	C0927	LAWRENCE CARTER	70.00		70.00
			ACCOUNT TOTAL	70.00	70.00-	0.00
05-18-77	1110	C0928	RAMADA INNS		205.39-	205.39-
05-18-77	7801	C0928	RAMADA INNS	183.79		183.79
05-18-77	7112	C0928	RAMADA INNS	21.60		21.60
			ACCOUNT TOTAL	205.39	205.39-	0.00
05-17-77	7414	C0929	RAMADA INNS	5.08		5.08
05-17-77	1110	C0929	RAMADA INNS		5.08-	5.08-
			ACCOUNT TOTAL	5.08	5.08-	0.00
05-18-77	4204	C0930	DEPT OF FINAC	690.96		690.96
05-18-77	1110	C0930	DEPT OF FINANCE		690.96-	690.96-
			ACCOUNT TOTAL	690.96	690.96-	0.00
05-18-77	1110	C0931	RADCO INN SUPP		280.19-	280.19-
05-18-77	7107	C0931	RADCO INN SUPP	280.19		280.19
			ACCOUNT TOTAL	280.19	280.19-	0.00
05-19-77	1110	C0932	JD SHAMBURGER		350.00-	350.00-
05-19-77	7418	C0932	JD SHAMBURGER	350.00		350.00
			ACCOUNT TOTAL	350.00	350.00-	0.00
05-19-77	7614	C0933	ZELLNER APPL	52.38		52.38
05-19-77	1110	C0933	ZELLNER APPL		52.38-	52.38-
			ACCOUNT TOTAL	52.38	52.38-	0.00
05-19-77	7701	C0934	ARKLA	1,213.80		1,213.80
05-19-77	1110	C0934	ARKLA		1,213.80-	1,213.80-
			ACCOUNT TOTAL	1,213.80	1,213.80-	0.00
05-19-77	7302	C0935	PEPSI-COLA	122.85		122.85
05-19-77	1110	C0935	PEPSI-COLA		122.85-	122.85-

	ACCOUNT TOTAL	122.85	122.85-	0.00
05-19-77 1110 C0936	HAMMETT LAUNDRY		258.25-	258.25-
05-19-77 7300 C0936	HAMMETT LAUNDRY	258.25		258.25
	ACCOUNT TOTAL	258.25	258.25-	0.00
05-19-77 7616 C0937	UNIVERSAL FENCE	87.80		87.80
05-19-77 1110 C0937	UNIVERSAL FENCE		87.80-	87.80-
	ACCOUNT TOTAL	87.80	87.80-	0.00
05-19-77 1110 C0938	HEATH & CO		306.94-	306.94-
05-19-77 7504 C0938	HEATH & CO	306.94		306.94
	ACCOUNT TOTAL	306.94	306.94-	0.00
05-19-77 1110 C0939	HEATH & CO		239.48-	239.48-
05-19-77 7504 C0939	HEATH & CO	239.48		239.48
	ACCOUNT TOTAL	239.48	239.48-	0.00
05-19-77 7302 C0940	COCA-COLA	202.92		202.92
05-19-77 1110 C0940	COCA-COLA		202.92-	202.92-
	ACCOUNT TOTAL	202.92	202.92-	0.00
05-19-77 7201 C0941	BELL TELE CO	629.06		629.06
05-19-77 1110 C0941	BELL TELE CO		1,712.20-	1,712.20-
05-19-77 7200 C0941	BELL TELE CO	924.19		924.19
05-19-77 7202 C0941	BELL TELE CO	158.95		158.95
	ACCOUNT TOTAL	1,712.20	1,712.20-	0.00-
05-19-77 7411 C0942	MOBIL OIL CO	84.67		84.67
05-19-77 1110 C0942	MOBIL OIL CO		84.67-	84.67-
	ACCOUNT TOTAL	84.67	84.67-	0.00
05-19-77 7603 C0943	MAULDINS INC	70.04		70.04
05-19-77 1110 C0943	MAULDING INC		70.04-	70.04-
	ACCOUNT TOTAL	70.04	70.04-	0.00
05-19-77 7613 C0944	RCA	146.75		146.75
05-19-77 1110 C0944	RCA		146.75-	146.75-
	ACCOUNT TOTAL	146.75	146.75-	0.00
05-19-77 7607 C0945	NABHOLZ SUPP	41.15		41.15
05-19-77 1110 C0945	NABHOLZ SUPP		41.15-	41.15-
	ACCOUNT TOTAL	41.15	41.15-	0.00
05-19-77 1110 C0946	LOG CABIN DEM		17.50-	17.50-
05-19-77 7502 C0946	LOG CABIN DEM	17.50		17.50
	ACCOUNT TOTAL	17.50	17.50-	0.00
05-19-77 7110 C0947	CENTRL ARK DUST	17.00		17.00
05-19-77 1110 C0947	CENTRL DAK DUST		17.00-	17.00-
	ACCOUNT TOTAL	17.00	17.00-	0.00
05-19-77 7503 C0948	CUERDEN SIGN CO	266.44		266.44
05-19-77 1110 C0948	CUERDEN SIGN CO		266.44-	266.44-
	ACCOUNT TOTAL	266.44	266.44-	0.00
05-19-77 7107 C0949	HEIGEL WHLSE	71.59		71.59
05-19-77 1110 C0949	HEIGEL WHLSE		71.59-	71.59-
	ACCOUNT TOTAL	71.59	71.59-	0.00
05-19-77 1110 C0950	HIEGEL LUMBER		202.56-	202.56-
05-19-77 7611 C0950	HIEGELLUMBER	202.56		202.56
	ACCOUNT TOTAL	202.56	202.56-	0.00
05-19-77 1110 C0951	HAMBUCHEN ELEC		197.47-	197.47-
05-19-77 7606 C0951	HAMBUCHEN ELEC	197.47		197.47
	ACCOUNT TOTAL	197.47	197.47-	0.00
05-19-77 1110 C0952	NATL BOOK DIST		259.59-	259.59-
05-19-77 7301 C0952	NATL BOOK DIST	259.59		259.59
	ACCOUNT TOTAL	259.59	259.59-	0.00
05-19-77 1110 C0953	KANSAS CITY WHT		397.58-	397.58-
05-19-77 7106 C0953	KANSAS CITY WHT	397.58		397.58
	ACCOUNT TOTAL	397.58	397.58-	0.00
05-19-77 1110 C0954	HANCO MFG CO		191.27-	191.27-
05-19-77 7108 C0954	HANCO MFG CO	191.27		191.27
	ACCOUNT TOTAL	191.27	191.27-	0.00
05-19-77 1110 C0955	KANSAS CITY WHT		697.31-	697.31-
05-19-77 7106 C0955	KANSAS CITY WHT	697.31		697.31
	ACCOUNT TOTAL	697.31	697.31-	0.00
05-19-77 1110 C0956	POOL CHEM INC		672.03-	672.03-
05-19-77 7612 C0956	POOL CHEM INC	672.03		672.03
	ACCOUNT TOTAL	672.03	672.03-	0.00
05-19-77 1110 C0957	TERMINIX INC		25.00-	25.00-
05-19-77 7111 C0957	TERMINIX INC	25.00		25.00
	ACCOUNT TOTAL	25.00	25.00-	0.00
05-19-77 1110 C0958	MAULDINS INC		59.40-	59.40-
05-19-77 7603 C0958	MAULDINS INC	59.40		59.40
	ACCOUNT TOTAL	59.40	59.40-	0.00
05-19-77 7410 C0959	BELL TELE CO	46.03		46.03
05-19-77 1110 C0959	BELL TELE CO		46.03-	46.03-
	ACCOUNT TOTAL	46.03	46.03-	0.00
05-19-77 7600 C0960	ERVIN EBSEN	53.48		53.48
05-19-77 1110 C0960	ERVIN EBSEN		53.48-	53.48-
	ACCOUNT TOTAL	53.48	53.48-	0.00
05-19-77 1110 C0961	ROB SHAMBURGER		24.15-	24.15-
05-19-77 7601 C0961	ROB SHAMBURGER	24.15		24.15
	ACCOUNT TOTAL	24.15	24.15-	0.00
05-20-77 1110 C0962	PAYROLL ACCT		1,910.66-	1,910.66-
05-20-77 1111 C0962	PAYROLL ACCT	1,910.66		1,910.66
	ACCOUNT TOTAL	1,910.66	1,910.66-	0.00
05-20-77 7112 C0963	EMP TRVL SER	8.40		8.40
05-20-77 1110 C0963	EMP TRVL SER		8.40-	8.40-
	ACCOUNT TOTAL	8.40	8.40-	0.00
05-24-77 1110 C0964	BOWENS REST		2,185.59-	2,185.59-
05-24-77 2134 C0964	BOWENS REST	2,185.59		2,185.59
	ACCOUNT TOTAL	2,185.59	2,185.59-	0.00
05-24-77 1110 C0965	SEARS		680.00-	680.00-
05-24-77 7616 C0965	SEARS	680.00		680.00
	ACCOUNT TOTAL	680.00	680.00-	0.00
05-24-77 7411 C0966	TEXACO	18.20		18.20
05-24-77 1110 C0966	TEXACEO		18.20-	18.20-
	ACCOUNT TOTAL	18.20	18.20-	0.00
05-25-77 7116 C0967	LAWRENCE CARTER	60.00		60.00
05-25-77 1110 C0967	LAWRENCE CARTER		60.00-	60.00-
	ACCOUNT TOTAL	60.00	60.00-	0.00
05-25-77 7411 C0968	MOVING - JDS	430.00		430.00
05-25-77 1110 C0968	MOVING - JDS		430.00-	430.00-
	ACCOUNT TOTAL	430.00	430.00-	0.00
05-25-77 7702 C0969	CONWAY CORP	64.00		64.00
05-25-77 7703 C0969	CONWAY CORP	97.75		97.75
05-25-77 7700 C0969	CONWAY CORP	2,151.01		2,151.01
05-25-77 1110 C0969	CONWAY CORP		2,312.76-	2,312.76-
	ACCOUNT TOTAL	2,312.76	2,312.76-	0.00
05-25-77 1110 C0970	CONWAY CORP		88.68-	88.68-
05-25-77 7702 C0970	CONWAY CORP	88.68		88.68
	ACCOUNT TOTAL	88.68	88.68-	0.00
05-25-77 7304 C0971	DA SPARKS INC	42.00		42.00
05-25-77 1110 C0971	DA SPARKS INC		42.00-	42.00-
	ACCOUNT TOTAL	42.00	42.00-	0.00
05-27-77 1110 C0972	ERVIN EBSEN		52.90-	52.90-
05-27-77 7600 C0972	ERVIN EBSEN	52.90		52.90
	ACCOUNT TOTAL	52.90	52.90-	0.00
05-27-77 1110 C0973	ROB SHAMBURGER		25.00-	25.00-
05-27-77 7601 C0973	ROB SHAMBURGER	25.00		25.00
	ACCOUNT TOTAL	25.00	25.00-	0.00
05-27-77 1110 C0974	JPAYROLL ACCT		1,476.41-	1,476.41-
05-27-77 1111 C0974	PAYROLL ACCT	1,476.41		1,476.41
	ACCOUNT TOTAL	1,476.41	1,476.41-	0.00
05-01-77 1130 V0501	ACCTS REC	558.74		558.74
05-01-77 4204 V0501	SALES TAX		12.81-	12.81-
05-01-77 1130 V0501	ACCTS REC		675.66-	675.66-
05-01-77 4102 V0501	TELEPHONE		17.64-	17.64-
05-01-77 4302 V0501	NEWSSTAND		11.86-	11.86-
05-01-77 4100 V0501	ROOM RENT		427.00-	427.00-
05-01-77 1129 V0501	CITY LEDGER	275.13		275.13
05-01-77 1110 V0501	BANK DEPOSIT	400.53		400.53
05-01-77 2134 V0501	DUE BOWENS		89.43-	89.43-
	ACCOUNT TOTAL	1,234.40	1,234.40-	0.00
05-02-77 4302 V0502	NEWSSTAND		13.82-	13.82-
05-02-77 1110 V0502	BANK DEPOSIT	2,012.19		2,012.19
05-02-77 1129 V0502	CITY LEDGER		1,590.13-	1,590.13-
05-02-77 4130 V0502	ACCTS REC		478.54-	478.54-
05-02-77 1130 V0502	ACCTS REC	1,407.78		1,407.78
05-02-77 4102 V0502	TELEPHONE		49.07-	49.07-
05-02-77 4100 V0502	ROOM RENT		1,189.00-	1,189.00-
05-02-77 1129 V0502	CR CARD DISC		2.07-	2.07-
05-02-77 2134 V0502	DUE BOWENS		87.92-	87.92-
05-02-77 4204 V0502	SALES TAX		25.67-	25.67-
05-02-77 4101 V0502	MEETING ROOM		25.00-	25.00-
05-02-77 1129 V0502	CITY LEDGER	56.48		56.48
05-02-77 4301 V0502	VALET		7.30-	7.30-
05-02-77 7400 V0502	CR CARD DISC	2.07		2.07
	ACCOUNT TOTAL	3,478.52	3,478.52-	0.00
05-03-77 4102 V0503	TELEPHONE		84.41-	84.41-
05-03-77 1130 V0503	ACCTS REC	1,377.16		1,377.16
05-03-77 4302 V0503	NEWSSTAND		23.88-	23.88-
05-03-77 2134 V0503	DUE BOWENS		100.84-	100.84-
05-03-77 1130 V0503	ACCTS REC		1,207.81-	1,207.81-
05-03-77 1129 V0503	CITY LEDGER	174.30		174.30
05-03-77 4204 V0503	SALES TAX		34.03-	34.03-
05-03-77 1110 V0503	BANK DEPOSIT	1,033.51		1,033.51
05-03-77 4100 V0503	ROOM RENT		1,134.00-	1,134.00-
	ACCOUNT TOTAL	2,584.97	2,584.97-	0.00
05-04-77 1129 V0504	CITY LEDGER	377.32		377.32
05-04-77 4302 V0504	NEWSSTAND		16.12-	16.12-
05-04-77 4204 V0504	SALES TAX		36.14-	36.14-
05-04-77 1129 V0504	CITY LEDGER		38.78-	38.78-
05-04-77 4102 V0504	TELEPHONE		106.19-	106.19-
05-04-77 1130 V0504	ACCTS REC	1,653.13		1,653.13
05-04-77 4100 V0504	ROOM RENT		1,203.90-	1,203.90-
05-04-77 2134 V0504	DUE BOWENS		288.53-	288.53-
05-04-77 1130 V0504	ACCTS REC		907.64-	907.64-
05-04-77 4301 V0504	VALET		2.25-	2.25-
05-04-77 1110 V0504	BANK DEPOSIT	569.10		569.10
	ACCOUNT TOTAL	2,599.55	2,599.55-	0.00
05-05-77 7400 V0505	CR CARD DISC	35.14		35.14
05-05-77 1130 V0505	ACCTS REC		705.45-	705.45-
05-05-77 1129 V0505	CR CARD DISC		35.14-	35.14-
05-05-77 4204 V0505	SALES TAX		36.32-	36.32-
05-05-77 4102 V0505	TELEPHONE		111.36-	111.36-
05-05-77 1129 V0505	CITY LEDGER	373.46		373.46
05-05-77 1130 V0505	ACCTS REC	1,570.16		1,570.16
05-05-77 1129 V0505	CITY LEDGER		1,066.75-	1,066.75-
05-05-77 4302 V0505	NEWSSTAND		13.48-	13.48-
05-05-77 4301 V0505	VALET		72.90-	72.90-
05-05-77 2134 V0505	DUE BOWENS		125.10-	125.10-
05-05-77 4100 V0505	ROOM RENT		1,210.00-	1,210.00-
05-05-77 1110 V0505	BANK DEPOSIT	1,398.74		1,398.74
	ACCOUNT TOTAL	3,377.50	3,377.50-	0.00
05-06-77 1130 V0506	ACCTS REC		2,716.23-	2,716.23-
05-06-77 4204 V0506	SALES TAX		30.33-	30.33-
05-06-77 1130 V0506	ACCTS REC	1,241.20		1,241.20
05-06-77 4100 V0506	ROOM RENT		1,010.90-	1,010.90-
05-06-77 4102 V0506	TELEPHONE		40.82-	40.82-
05-06-77 4302 V0506	NEWSSTAND		9.19-	9.19-
05-06-77 4301 V0506	VALET		4.25-	4.25-
05-06-77 2134 V0506	DUE BOWENS		146.51-	146.51-
05-06-77 1110 V0506	BANK DEPOSIT	1,687.19		1,687.19
05-06-77 1129 V0506	CITY LEDGER	1,029.04		1,029.04
	ACCOUNT TOTAL	3,957.43	3,957.43-	0.00
05-07-77 4100 V0507	ROOM RENT		976.00-	976.00-
05-07-77 4204 V0507	SALES TAX		29.28-	29.28-
05-07-77 1129 V0507	ACCTS REC	1,104.36		1,104.36
05-07-77 1130 V0507	ACCTS REC		1,309.43-	1,309.43-
05-07-77 4102 V0507	TELEPHONE		48.07-	48.07-
05-07-77 1129 V0507	CITY LEDGER	426.54		426.54
05-07-77 4302 V0507	NEWSSTAND		7.50-	7.50-
05-07-77 1110 V0507	BANK DEPOSIT	882.89		882.89
05-07-77 2134 V0507	DUE BOWENS		43.51-	43.51-
	ACCOUNT TOTAL	2,413.79	2,413.79-	0.00
05-08-77 4100 V0508	ROOM RENT		443.40-	443.40-
05-08-77 2134 V0508	DUE BOWENS		139.72-	139.72-
05-08-77 4302 V0508	NEWSSTAND		11.68-	11.68-
05-08-77 4204 V0508	SALES TAX		13.31-	13.31-
05-08-77 4102 V0508	TELEPHONE		73.82-	73.82-
05-08-77 1130 V0508	ACCTS REC		996.15-	996.15-
05-08-77 1129 V0508	CITY LEDGER	336.46		336.46
05-08-77 1110 V0508	BANK DEPOSIT	659.69		659.69
05-08-77 1130 V0508	ACCTS REC	681.93		681.93
	ACCOUNT TOTAL	1,678.08	1,678.08-	0.00
05-09-77 4302 V0509	NEWSSTAND		38.63-	38.63-
05-09-77 4102 V0509	TELEPHONE		64.47-	64.47-
05-09-77 1110 V0509	BANK DEPOSIT	1,555.14		1,555.14
05-09-77 7400 V0509	CR CARD DISC	28.15		28.15
05-09-77 1129 V0509	CR CARD DISC		28.15-	28.15-
05-09-77 1129 V0509	CITY LEDGER	154.25		154.25
05-09-77 4101 V0509	MEETING ROOM		25.00-	25.00-
05-09-77 4204 V0509	SALES TAX		27.14-	27.14-
05-09-77 1129 V0509	CITY LEDGER		975.81-	975.81-
05-09-77 2134 V0509	DUE BOWENS		69.92-	69.92-
05-09-77 4100 V0509	ROOM RENT		904.50-	904.50-
05-09-77 1130 V0509	ACCTS REC	1,181.01		1,181.01
05-09-77 4301 V0509	VALET		51.35-	51.35-
05-09-77 1130 V0509	ACCTS REC		733.58-	733.58-
	ACCOUNT TOTAL	2,918.55	2,918.55-	0.00
05-10-77 4302 V0510	NEWSSTAND		52.02-	52.02-
05-10-77 1110 V0510	BANK DEPOSIT	960.86		960.86
05-10-77 4100 V0510	ROOM RENT		949.50-	949.50-
05-10-77 1130 V0510	ACCTS REC	1,298.47		1,298.47
05-10-77 4301 V0510	VALET		10.00-	10.00-
05-10-77 4204 V0510	SALES TAX		28.07-	28.07-
05-10-77 1129 V0510	CITY LEDGER		145.90-	145.90-
05-10-77 2134 V0510	DUE BOWENS		207.68-	207.68-
05-10-77 4102 V0510	TELEPHONE		51.20-	51.20-
05-10-77 7400 V0510	CR CARD DISC	7.68		7.68
05-10-77 1130 V0510	ACCTS REC		1,011.82-	1,011.82-
05-10-77 1129 V0510	CR CARD DISC		7.68-	7.68-
05-10-77 1129 V0510	CITY LEDGER	196.86		196.86
	ACCOUNT TOTAL	2,463.87	2,463.87-	0.00
05-11-77 2134 V0511	DUE BOWENS		278.77-	278.77-
05-11-77 1130 V0511	ACCTS REC		1,050.78-	1,050.78-
05-11-77 4101 V0511	MEETING ROOM		25.00-	25.00-
05-11-77 4302 V0511	NEWSSTAND		21.47-	21.47-
05-11-77 1129 V0511	CITY LEDGER		28.93-	28.93-
05-11-77 1129 V0511	CITY LEDGER	559.88		559.88
05-11-77 4100 V0511	ROOM RENT		1,230.00-	1,230.00-

05-11-77 4102 V0511 TELEPHONE			69.42-	69.42-
05-11-77 1129 V0511 CR CARD DISC			1.21-	1.21-
05-11-77 4204 V0511 SALES TAX			36.99-	36.99-
05-11-77 1110 V0511 BANK DEPOSIT	519.83			519.83
05-11-77 7400 V0511 CR CARD DISC	1.21			1.21
05-11-77 1130 V0511 ACCTS REC	1,661.65			1,661.65
ACCOUNT TOTAL	2,742.57		2,742.57-	0.00
05-12-77 1130 V0512 ACCTS REC	1,410.88			1,410.88
05-12-77 2134 V0512 DUE BOWENS			169.54-	169.54-
05-12-77 1129 V0512 CITY LEDGER	420.20			420.20
05-12-77 4302 V0512 NEWSSTAND			40.70-	40.70-
05-12-77 1110 V0512 BANK DEPOSIT	874.51			874.51
05-12-77 1130 V0512 ACCTS REC			1,294.71-	1,294.71-
05-12-77 4102 V0512 TELEPHONE			84.03-	84.03-
05-12-77 4100 V0512 ROOM RENT			1,084.00-	1,084.00-
05-12-77 4204 V0512 SALES TAX			32.61-	32.61-
ACCOUNT TOTAL	2,705.59		2,705.59-	0.00
05-13-77 4302 V0513 NEWSSTAND			8.25-	8.25-
05-13-77 4102 V0513 TELEPHONE			60.19-	60.19-
05-13-77 1129 V0513 CITY LEDGER			317.77-	317.77-
05-13-77 1129 V0513 CR CARD DISC			10.45-	10.45-
05-13-77 7400 V0513 CR CARD DISC	10.45			10.45
05-13-77 4301 V0513 VALET			5.00-	5.00-
05-13-77 4204 V0513 SALES TAX			39.16-	39.16-
05-13-77 1129 V0513 CITY LEDGER	657.10			657.10
05-13-77 1130 V0513 ACCTS REC			1,467.72-	1,467.72-
05-13-77 4100 V0513 ROOM RENT			1,302.50-	1,302.50-
05-13-77 2134 V0513 DUE BOWENS			151.89-	151.89-
05-13-77 1110 V0513 BANK DEPOSIT	1,128.40			1,128.40
05-13-77 1130 V0513 ACCTS REC	1,566.99			1,566.99
ACCOUNT TOTAL	3,362.94		3,362.94-	0.00
05-14-77 4302 V0514 NEWSSTAND			5.69-	5.69-
05-14-77 2134 V0514 DUE BOWENS			159.47-	159.47-
05-14-77 1130 V0514 ACCTS REC			1,589.33-	1,589.33-
05-14-77 4204 V0514 SALES TAX			28.31-	28.31-
05-14-77 1129 V0514 CITY LEDGER	553.65			553.65
05-14-77 4102 V0514 TELEPHONE			51.27-	51.27-
05-14-77 4100 V0514 ROOM RENT			940.50-	940.50-
05-14-77 1130 V0514 ACCTS REC	1,195.24			1,195.24
05-14-77 1110 V0514 BANK DEPOSIT	1,025.68			1,025.68
ACCOUNT TOTAL	2,774.57		2,774.57-	0.00
05-15-77 4302 V0515 NEWSSTAND			7.84-	7.84-
05-15-77 2134 V0515 DUE BOWENS			126.76-	126.76-
05-15-77 4102 V0515 TELEPHONE			23.68-	23.68-
05-15-77 1129 V0515 CITY LEDGER	449.67			449.67
05-15-77 1110 V0515 BANK DEPOSIT	1,257.23			1,257.23
05-15-77 4100 V0515 ROOM RENT			492.00-	492.00-
05-15-77 1130 V0515 ACCTS REC	666.07			666.07
05-15-77 4204 V0515 SALES TAX			14.79-	14.79-
05-15-77 1130 V0515 ACCTS REC			1,706.90-	1,706.90-
ACCOUNT TOTAL	2,372.97		2,372.97-	0.00
05-16-77 1129 V0516 CR CARD DISC			35.24-	35.24-
05-16-77 1130 V0516 ACCTS REC	1,526.86			1,526.86
05-16-77 4302 V0516 NEWSSTAND			19.15-	19.15-
05-16-77 7400 V0516 CR CARD DISC	35.24			35.24
05-16-77 1129 V0516 CITY LEDGER	222.20			222.20
05-16-77 2134 V0516 DUE BOWENS			117.00-	117.00-
05-16-77 4101 V0516 MEETING ROOM			25.00-	25.00-
05-16-77 4102 V0516 TELEPHONE			57.35-	57.35-
05-16-77 1110 V0516 BANK DEPOSIT	1,561.17			1,561.17
05-16-77 1129 V0516 CITY LEDGER			1,235.05-	1,235.05-
05-16-77 1130 V0516 ACCTS REC			548.32-	548.32-
05-16-77 4204 V0516 SALES TAX			37.56-	37.56-
05-16-77 4100 V0516 ROOM RENT			1,270.80-	1,270.80-
ACCOUNT TOTAL	3,345.47		3,345.47-	0.00
05-17-77 2134 V0517 DUE BOWENS			167.98-	167.98-
05-17-77 1130 V0517 ACCTS REC	1,649.43			1,649.43
05-17-77 4302 V0517 NEWSSTAND			23.52-	23.52-
05-17-77 4102 V0517 TELEPHONE			91.93-	91.93-
05-17-77 1110 V0517 BANK DEPOSIT	762.85			762.85
05-17-77 1130 V0517 ACCTS REC			967.64-	967.64-
05-17-77 4204 V0517 SALES TAX			39.64-	39.64-
05-17-77 4301 V0517 VALET			7.35-	7.35-
05-17-77 4100 V0517 ROOM RENT			1,319.00-	1,319.00-
05-17-77 1129 V0517 CITY LEDGER	203.79			203.79
ACCOUNT TOTAL	2,617.07		2,617.07-	0.00
05-18-77 1130 V0518 ACCTS REC	1,471.63			1,471.63
05-18-77 2134 V0518 DUE BOWENS			114.21-	114.21-
05-18-77 4102 V0518 TELEPHONE			133.34-	133.34-
05-18-77 4204 V0518 SALES TAX			34.72-	34.72-
05-18-77 1130 V0518 ACCTS REC			790.82-	790.82-
05-18-77 1129 V0518 CITY LEDGER	299.24			299.24
05-18-77 4301 V0518 VALET			23.45-	23.45-
05-18-77 4100 V0518 ROOM RENT			1,155.00-	1,155.00-
05-18-77 4302 V0518 NEWSSTAND			10.91-	10.91-
05-18-77 1110 V0518 BANK DEPOSIT	491.58			491.58
ACCOUNT TOTAL	2,262.45		2,262.45-	0.00
05-19-77 1130 V0519 ACCTS REC			1,687.47-	1,687.47-
05-19-77 4302 V0519 NEWSSTAND			5.88-	5.88-
05-19-77 1129 V0519 CITY LEDGER			256.75-	256.75-
05-19-77 1130 V0519 ACCTS REC	1,567.92			1,567.92
05-19-77 4102 V0519 TELEPHONE			71.16-	71.16-
05-19-77 1129 V0519 CITY LEDGER	748.21			748.21
05-19-77 4100 V0519 ROOM RENT			1,305.00-	1,305.00-
05-19-77 4204 V0519 SALES TAX			39.21-	39.21-
05-19-77 2134 V0519 DUE BOWENS			146.67-	146.67-
05-19-77 1110 V0519 BANK DEPOSIT	1,196.01			1,196.01
ACCOUNT TOTAL	3,512.14		3,512.14-	0.00
05-20-77 1129 V0520 CITY LEDGER			2,345.98-	2,345.98-
05-20-77 7400 V0520 CR CARD DISC	71.30			71.30
05-20-77 4204 V0520 SALES TAX			43.65-	43.65-
05-20-77 4102 V0520 TELEPHONE			43.06-	43.06-
05-20-77 4302 V0520 NEWSSTAND			10.36-	10.36-
05-20-77 1129 V0520 CITY LEDGER	666.63			666.63
05-20-77 1130 V0520 ACCTS REC			2,403.71-	2,403.71-
05-20-77 2134 V0520 DUE BOWENS			165.47-	165.47-
05-20-77 1130 V0520 ACCTS REC	1,717.54			1,717.54
05-20-77 1129 V0520 CR CARD DISC			71.30-	71.30-
05-20-77 4100 V0520 ROOM RENT			1,455.00-	1,455.00-
05-20-77 1110 V0520 BANK DEPOSIT	4,082.06			4,082.06
ACCOUNT TOTAL	6,538.53		6,538.53-	0.00
05-21-77 4102 V0521 TELEPHONE			11.19-	11.19-
05-21-77 1130 V0521 ACCTS REC	788.22			788.22
05-21-77 1129 V0521 CITY LEDGER	965.32			965.32
05-21-77 4302 V0521 NEWSSTAND			15.78-	15.78-
05-21-77 1110 V0521 BANK DEPOSIT	1,544.46			1,544.46
05-21-77 1130 V0521 ACCTS REC			2,509.78-	2,509.78-
05-21-77 4204 V0521 SALES TAX			21.42-	21.42-
05-21-77 2134 V0521 DUE BOWENS			46.87-	46.87-
05-21-77 4100 V0521 ROOM RENT			693.00-	693.00-
ACCOUNT TOTAL	3,298.00		3,298.00-	0.00
05-22-77 4102 V0522 TELEPHONE			11.71-	11.71-
05-22-77 1130 V0522 ACCTS REC	539.31			539.31
05-22-77 4204 V0522 SALES TAX			14.19-	14.19-
05-22-77 1110 V0522 BANK DEPOSIT	625.77			625.77
05-22-77 1129 V0522 CITY LEDGER	94.76			94.76
05-22-77 4302 V0522 NEWSSTAND			1.76-	1.76-
05-22-77 1130 V0522 ACCTS REC			720.53-	720.53-
05-22-77 2134 V0522 DUE BOWENS			38.65-	38.65-
05-22-77 4100 V0522 ROOM RENT			473.00-	473.00-
ACCOUNT TOTAL	1,259.84		1,259.84-	0.00
05-23-77 4102 V0523 TELEPHONE			113.95-	113.95-
05-23-77 4100 V0523 ROOM RENT			1,142.00-	1,142.00-
05-23-77 1130 V0523 ACCTS REC			630.70-	630.70-
05-23-77 7400 V0523 CR CARD DISC	4.10			4.10
05-23-77 4302 V0523 NEWSSTAND			20.58-	20.58-
05-23-77 2134 V0523 DUE BOWENS			133.31-	133.31-

05-23-77 1129 V0523 CR CARD DISC		4.10-	4.10-
05-23-77 1129 V0523 CITY LEDGER	184.07		184.07
05-23-77 4204 V0523 SALES TAX		34.32-	34.32-
05-23-77 1130 V0523 ACCTS REC	1,469.16		1,469.16
05-23-77 1129 V0523 CITY LEDGER		147.85-	147.85-
05-23-77 4101 V0523 MEETING ROOM		25.00-	25.00-
05-23-77 1110 V0523 BANK DEPOSIT	594.48		594.48
ACCOUNT TOTAL	2,251.81	2,251.81-	0.00
05-24-77 1129 V0524 CITY LEDGER	141.79		141.79
05-24-77 4100 V0524 ROOM RENT		1,299.00-	1,299.00-
05-24-77 4102 V0524 TELEPHONE		58.34-	58.34-
05-24-77 1130 V0524 ACCTS REC		654.54-	654.54-
05-24-77 1130 V0524 ACCTS REC	1,552.52		1,552.52
05-24-77 4204 V0524 SALES TAX		39.03-	39.03-
05-24-77 1110 V0524 BANK DEPOSIT	512.75		512.75
05-24-77 2134 V0524 DUE BOWENS		153.95-	153.95-
05-24-77 4302 V0524 NEWSSTAND		2.20-	2.20-
ACCOUNT TOTAL	2,207.06	2,207.06-	0.00
05-25-77 2134 V0525 DUE BOWENS		149.66-	149.66-
05-25-77 4301 V0525 VALET		5.50-	5.50-
05-25-77 1130 V0525 ACCTS REC	1,680.71		1,680.71
05-25-77 1110 V0525 BANK DEPOSIT	744.97		744.97
05-25-77 4204 V0525 SALES TAX		40.73-	40.73-
05-25-77 4302 V0525 NEWSSTAND		22.46-	22.46-
05-25-77 4102 V0525 TELEPHONE		95.36-	95.36-
05-25-77 1129 V0525 CITY LEDGER	425.41		425.41
05-25-77 4101 V0525 MEETING ROOM		15.00-	15.00-
05-25-77 1130 V0525 ACCTS REC		1,170.38-	1,170.38-
05-25-77 4100 V0525 ROOM RENT		1,352.00-	1,352.00-
ACCOUNT TOTAL	2,851.09	2,851.09-	0.00
05-26-77 4301 V0526 VALET		9.63-	9.63-
05-26-77 4302 V0526 NEWSSTAND		9.31-	9.31-
05-26-77 4100 V0526 ROOM RENT		962.00-	962.00-
05-26-77 1130 V0526 ACCTS REC	1,197.31		1,197.31
05-26-77 4102 V0526 TELEPHONE		98.16-	98.16-
05-26-77 2134 V0526 DUE BOWENS		88.26-	88.26-
05-26-77 1129 V0526 CITY LEDGER	594.77		594.77
05-26-77 1110 V0526 BANK DEPOSIT	835.93		835.93
05-26-77 4204 V0526 SALES TAX		28.95-	28.95-
05-26-77 1130 V0526 ACCTS REC		1,430.78-	1,430.78-
ACCOUNT TOTAL	2,628.01	2,628.01-	0.00
05-27-77 1110 V0527 BANK DEPOSIT	1,833.89		1,833.89
05-27-77 4100 V0527 ROOM RENT		1,571.00-	1,571.00-
05-27-77 4204 V0527 SALES TAX		47.13-	47.13-
05-27-77 4302 V0527 NEWSSTAND		14.94-	14.94-
05-27-77 1130 V0527 ACCTS REC	1,797.17		1,797.17
05-27-77 2134 V0527 DUE BOWENS		135.01-	135.01-
05-27-77 4102 V0527 TELEPHONE		29.09-	29.09-
05-27-77 1129 V0527 CR CARD DISC		24.08-	24.08-
05-27-77 7400 V0527 CR CARD DISC	24.08		24.08
05-27-77 1130 V0527 ACCTS REC		1,989.18-	1,989.18-
05-27-77 1129 V0527 CITY LEDGER	612.81		612.81
05-27-77 1129 V0527 CITY LEDGER		457.52-	457.52-
ACCOUNT TOTAL	4,267.95	4,267.95-	0.00
05-28-77 4100 V0528 ROOM RENT		1,662.00-	1,662.00-
05-28-77 1130 V0528 ACCTS REC		1,683.65-	1,683.65-
05-28-77 4204 V0528 SALES TAX		49.89-	49.89-
05-28-77 2134 V0528 DUE BOWENS		156.24-	156.24-
05-28-77 4302 V0528 NEWSSTAND		20.69-	20.69-
05-28-77 1130 V0528 ACCTS REC	1,933.13		1,933.13
05-28-77 1129 V0528 CITY LEDGER	1,188.78		1,188.78
05-28-77 4102 V0528 TELEPHONE		33.31-	33.31-
05-28-77 1110 V0528 BANK DEPOSIT	494.87		494.87
ACCOUNT TOTAL	2,616.78	2,616.78-	0.00
05-29-77 4302 V0529 NEWSSTAND		19.89-	19.89-
05-29-77 4102 V0529 TELEPHONE		24.81-	24.81-
05-29-77 4204 V0529 SALES TAX		24.27-	24.27-

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05-29-77 4100 V0529 ROOM RENT                          809.00-      809.00-
05-29-77 1110 V0529 BANK DEPOSIT       1,625.96                   1,625.96
05-29-77 1130 V0529 ACCTS REC          1,032.37                   1,032.37
05-29-77 1129 V0529 CITY LEDGER        1,011.52                   1,011.52
05-29-77 1130 V0529 ACCTS REC                      2,637.48-      2,637.48-
05-29-77 2134 V0529 DUE BOWENS                       154.40-        154.40-
              ACCOUNT TOTAL            3,669.85    3,669.85-        0.00-

05-30-77 2134 V0530 DUE BOWENS                        97.98-       97.98-
05-30-77 4204 V0530 SALES TAX                         20.76-       20.76-
05-30-77 1129 V0530 CITY LEDGER          208.69                     208.69
05-30-77 1110 V0530 BANK DEPOSIT       1,117.53                   1,117.53
05-30-77 1130 V0530 ACCTS REC                      1,146.89-      1,146.89-
05-30-77 4102 V0530 TELEPHONE                         22.95-       22.95-
05-30-77 4100 V0530 ROOM RENT                        692.00-      692.00-
05-30-77 1130 V0530 ACCTS REC            838.02                     838.02
05-30-77 4302 V0530 NEWSSTAND                          4.33-        4.33-

05-30-77 1129 V0530 CITY LEDGER                      179.33-      179.33-
              ACCOUNT TOTAL            2,164.24    2,164.24-        0.00-

05-31-77 4102 V0531 TELEPHONE                         63.92-       63.92-
05-31-77 1129 V0531 CITY LEDGER          147.41                     147.41
05-31-77 7400 V0531 CR CARD DISC          95.02                      95.02
05-31-77 4302 V0531 NEWSSTAND                         21.79-       21.79-
05-31-77 1130 V0531 ACCTS REC            1,562.00                   1,562.00
05-31-77 1129 V0531 CITY LEDGER                    2,822.75-      2,822.75-
05-31-77 4100 V0531 ROOM RENT                      1,230.00-      1,230.00-
05-31-77 1110 V0531 BANK DEPOSIT       3,348.53                   3,348.53
05-31-77 2134 V0531 DUE BOWENS                       209.38-        209.38-
05-31-77 4204 V0531 SALES TAX                         36.91-       36.91-
05-31-77 1130 V0531 ACCTS REC                        673.19-      673.19-
05-31-77 1129 V0531 CR CARD DISC                      95.02-       95.02-
              ACCOUNT TOTAL            5,152.96    5,152.96-        0.00-

05-09-77 1110 V0532 TELE COMM             19.17                      19.17
05-09-77 4200 V0532 TELE COMM                         19.17-       19.17-
              ACCOUNT TOTAL               19.17       19.17-        0.00

05-24-77 1110 V0533 POP MACHINES         123.19                     123.19
05-24-77 4304 V0533 POP MACHINES                     123.19-      123.19-
              ACCOUNT TOTAL              123.19      123.19-        0.00

05-09-77 1110 V0534 COKES                 92.90                      92.90
05-09-77 4304 V0534 COKES                             92.90-       92.90-
              ACCOUNT TOTAL               92.90       92.90-        0.00

05-23-77 1110 V0535 DEPOSIT            1,225.22                   1,225.22
05-23-77 7700 V0535 BOWENS ELECTRIC                1,116.25-      1,116.25-
05-23-77 4205 V0535 BOWENS CR DISC                   108.97-      108.97-
              ACCOUNT TOTAL            1,225.22    1,225.22-        0.00

05-19-77 1110 V0536 DEPOSIT              890.01                     890.01
05-19-77 7611 V0536 BOWENS HALF                      890.01-      890.01-
              ACCOUNT TOTAL              890.01      890.01-        0.00

05-17-77 4304 V0537 POP MACHINE                       52.81-       52.81-
05-17-77 4300 V0537 GAME MACHINE                      37.25-       37.25-
05-17-77 1110 V0537 DEPOSIT               90.06                      90.06
              ACCOUNT TOTAL               90.06       90.06-        0.00

05-31-77 7400 V0538 CR CD DISCOUNTS      126.09                     126.09
05-31-77 1110 V0538 BANK                             126.09-      126.09-
              ACCOUNT TOTAL              126.09      126.09-        0.00

05-06-77 4303 V0539 CIG MACHINE                       21.60-       21.60-
05-06-77 1110 V0539 DEPOSIT               42.28                      42.28

05-06-77 4306 V0539 CANDY                             20.68-       20.68-
              ACCOUNT TOTAL               42.28       42.28-        0.00

05-19-77 7602 V0540 MAINTANENCE           36.23                      36.23
05-19-77 7104 V0540 MAIDS                374.84                     374.84
05-19-77 2110 V0540 FIT                                21.60-       21.60-

05-19-77 7103 V0540 LINEN BOYS            52.45                      52.45
05-19-77 7101 V0540 CLERKS & AUDITOR     367.49                     367.49
05-19-77 2109 V0540 SIT                                 5.14-        5.14-
05-19-77 1111 V0540 PAYROLL                        1,672.73-      1,672.73-
05-19-77 7105 V0540 LAUNDRY              171.06                     171.06
05-19-77 2111 V0540 FICA                             105.60-      105.60-
              ACCOUNT TOTAL            1,805.07    1,805.07-        0.00-

05-22-77 7100 V0541 GEN MGR              375.00                     375.00
05-22-77 2109 V0541 SIT                                 4.71-        4.71-
05-22-77 7602 V0541 MAINTANENCE           28.75                      28.75
05-22-77 7101 V0541 CLERKS & AUDITOR     350.63                     350.63
05-22-77 2110 V0541 FIT                                19.70-       19.70-
05-22-77 7103 V0541 LINEN BOYS            53.00                      53.00
05-22-77 7104 V0541 MAIDS                374.83                     374.83
05-22-77 7105 V0541 LAUNDRY              159.60                     159.60
05-22-77 1111 V0541 PAYROLL                        1,288.81-      1,288.81-
05-22-77 2111 V0541 FICA                              81.59-       81.59-
05-22-77 7102 V0541 HOUSEKEEPTER          53.00                      53.00
              ACCOUNT TOTAL            1,394.81    1,394.81-        0.00

05-12-77 7602 V0542 MAINTANENCE           42.55                      42.55
05-12-77 7100 V0542 GEN MGR            2,250.00                   2,250.00
05-12-77 1111 V0542 PAYROLL                        2,994.03-      2,994.03-
05-12-77 7104 V0542 MAIDS                356.14                     356.14
05-12-77 7101 V0542 CLERKS & AUDITOR     324.68                     324.68
05-12-77 7102 V0542 HOUSEKEEPER           53.00                      53.00
05-12-77 7103 V0542 LINEN BOYS            47.00                      47.00
05-12-77 2109 V0542 SIT                                 4.36-        4.36-
05-12-77 2111 V0542 FICA                             187.63-      187.63-
05-12-77 7105 V0542 LAUNDRY              134.25                     134.25
05-12-77 2110 V0542 FIT                                21.60-       21.60-
              ACCOUNT TOTAL            3,207.62    3,207.62-        0.00-

05-06-77 7101 V0543 CLERKS & AUDITOR     316.01                     316.01
05-06-77 7100 V0543 GEN MGR              750.00                     750.00
05-06-77 1111 V0543 PAYROLL                        1,530.73-      1,530.73-
05-06-77 7102 V0543 HOUSEKEEPER           53.00                      53.00
05-06-77 2110 V0543 FIT                                19.60-       19.60-
05-06-77 2111 V0543 FICA                               96.60-       96.60-
05-06-77 7104 V0543 MAIDS                317.85                     317.85

05-06-77 7602 V0543 MAINTANENCE           40.25                      40.25
05-06-77 7103 V0543 LINEN BOYS            52.92                      52.92
05-06-77 2109 V0543 SIT                                 4.36-        4.36-
05-06-77 7105 V0543 LAUNDRY              121.26                     121.26
              ACCOUNT TOTAL            1,651.29    1,651.29-        0.00

05-04-77 4201 V0544 BOWENS LEASE                   1,300.00-      1,300.00-
05-04-77 1110 V0544 DEPOSIT            1,300.00                   1,300.00
              ACCOUNT TOTAL            1,300.00    1,300.00-        0.00

05-02-77 1110 V0545 DEPOSIT              500.00                     500.00
05-02-77 4203 V0545 MOBIL LEASE                      500.00-      500.00-
              ACCOUNT TOTAL              500.00      500.00-        0.00

05-31-77 7902 V0546 UNPAID TAXES         4,842.82                   4,842.82
05-31-77 2100 V0546 UNPAID TAXES                   4,842.82-      4,842.82-
              ACCOUNT TOTAL            4,842.82    4,842.82-        0.00

05-31-77 2134 V0547 DUE BOWENS            86.34                      86.34
05-31-77 4204 V0547 TAX                   14.75                      14.75
05-31-77 1129 V0547 BAD ACCOUNTS                     639.24-      639.24-
05-31-77 4102 V0547 PHONE                 80.65                      80.65
05-31-77 4100 V0547 ROOM RENT            457.50                     457.50
              ACCOUNT TOTAL              639.24      639.24-        0.00

         TOT INS. TAX. & DEPR         150,170.96  150,170.96-        0.00

         TOTAL EXPENSES               150,170.96  150,170.96-        0.00

         PROFIT(-) OR LOSS(+)         150,170.96  150,170.96-        0.00
```

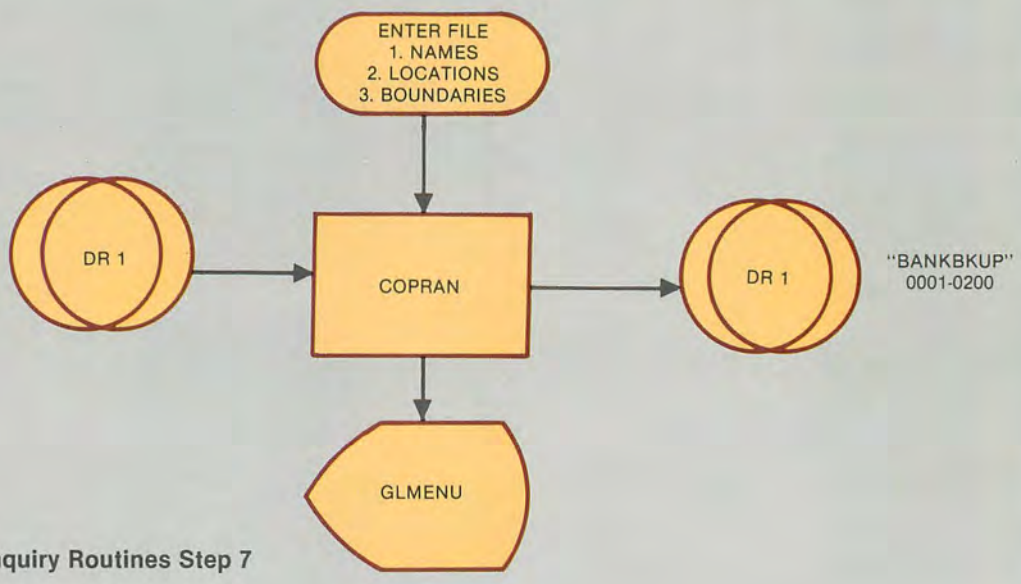
Monthly Step #7 — Copy BANKCURR to BANKBKUP

FLOW DIAGRAM

STEP 7

PROGRAM "COPRAN"

"BANKCURR"
0201-0400



Sample of Terminal Inquiry Routines Step 7 Program COPRAN

```
COPY * BASIC-RANDOM-FILES *
ENTER -INPUT- FILE NAME? BANKCURR
ENTER -OUTPUT-FILE NAME? BANKBKUP
ENTER -INPUT-DR#? 1
ENTER -OUTPUT-DR#? 1
ENTER -INPUT-BEG REC#? 201
ENTER -INPUT- END REC#? 400
ENTER -OUTPUT- BEG REC#? 1
ENTER -OUTPUT- END REC# 200
TO MOUNT THE FILES ENTER -Y-? N

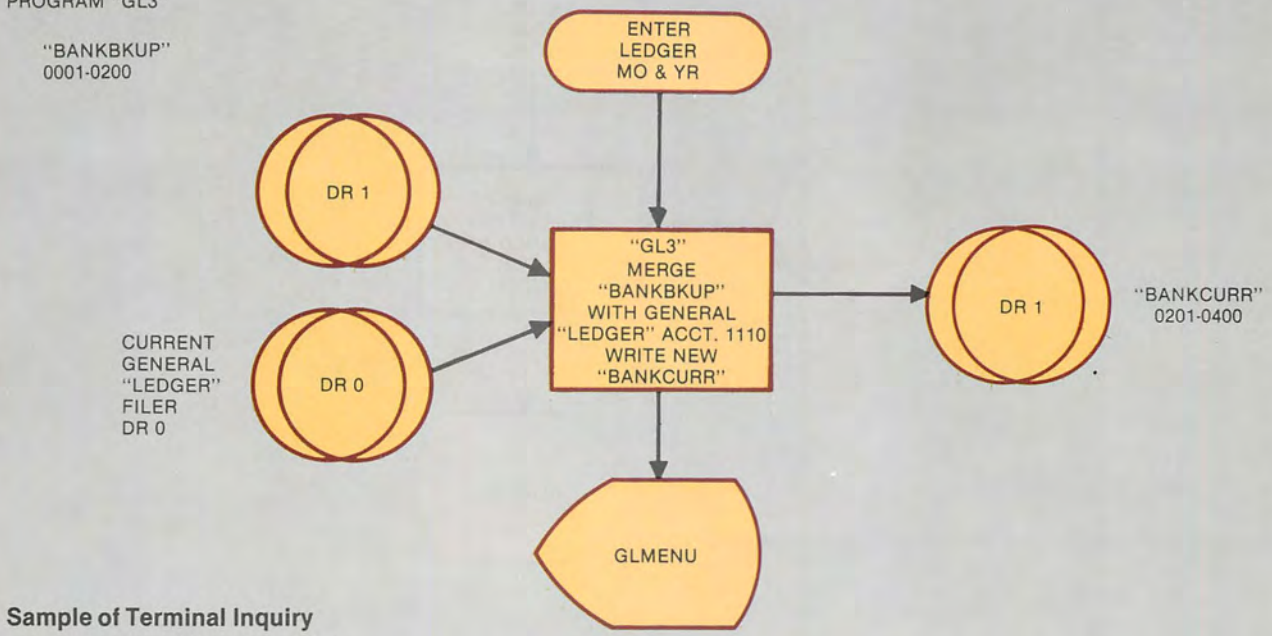
THE COPY IS MONITORED ON THE TERMINAL AS IN STEP 4
```

Monthly Step #8 — Merge BANKBKUP with Ledger Account 1110 and BANKCURR

FLOW DIAGRAM

STEP 8

PROGRAM "GL3"



Sample of Terminal Inquiry Routines Step 8 Program GL3

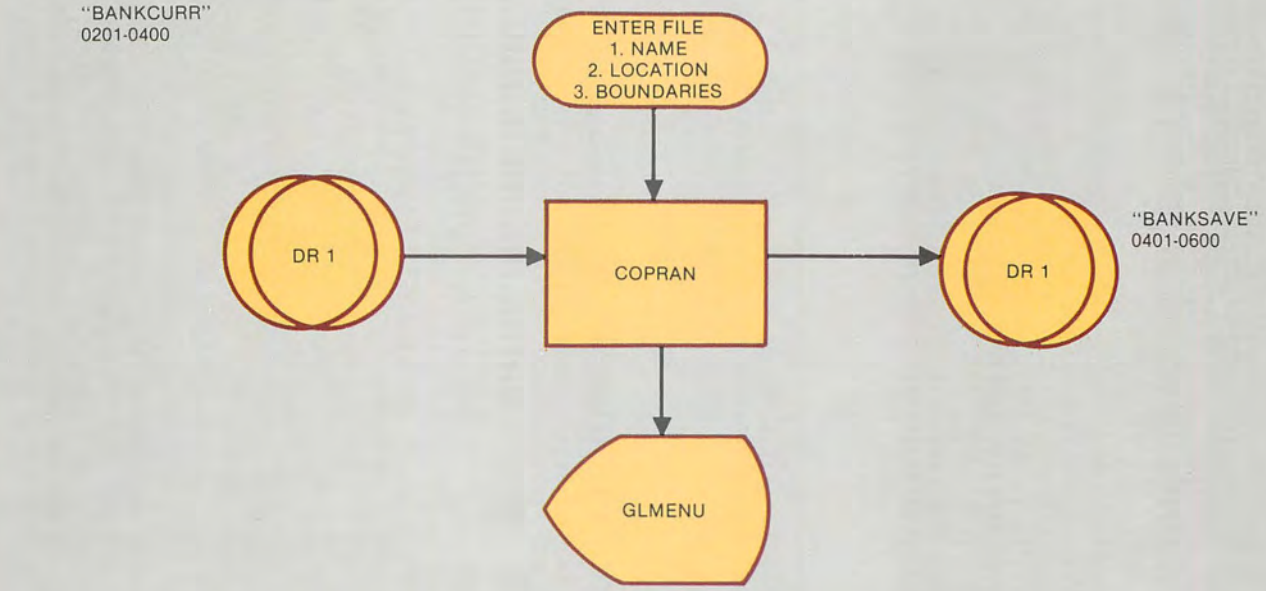
```
ENTER -Y- TO MOUNT THE FILES? N
*BEFORE RUNNING THIS PROGRAM - COPY BANKCURR TO BANKBKUP *
MERGE-LEDGER-DR0 AND -BANKBKUP-DR1 AND CUT NEW -BANKCURR-DR1
ENTER REPORT DATE AS MOYR? 0577
```

Monthly Step #9 — Copy BANKCURR to BANKSAVE

FLOW DIAGRAM

STEP 9

PROGRAM "COPRAN"



The Terminal Inquiry Routines for Step 9 are the same as Step 4 and Step 7.

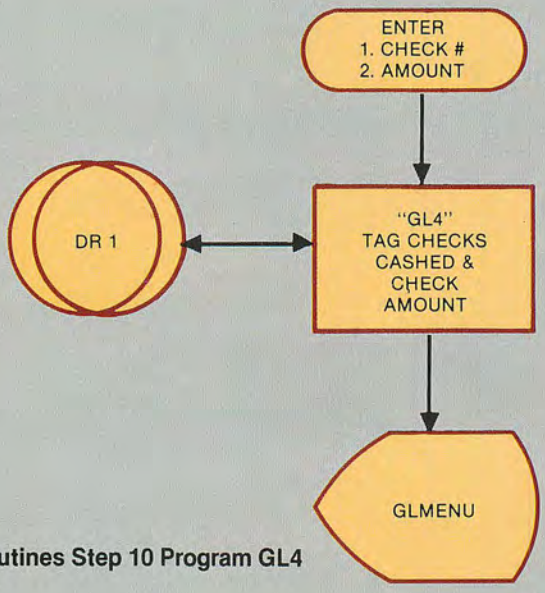
Monthly Step #10 — Enter Cancelled Check Number and Amount

FLOW DIAGRAM

STEP10

PROGRAM "GL4"

"BANKCURR"



Sample of Terminal Inquiry Routines Step 10 Program GL4

```
TAG CHECKS CASHED - 500 ENTRIES MAX
ENTER -Y- TO MOUNT THE FILE? N
ENTER REPORT DATE AS MOYR? 0577
  CHEK    AMOUNT
  NMBR $$$,$$$.$$
?
(ENTER -T- TO TERMINATE INPUT TO THE PROGRAM AND START PROCESSING)
(KEY IN ALL DECIMAL POINTS TO THE RIGHT OF DIGITS

** THE TERMINAL INQUIRY ROUTINES AND LINE PRINTER COPY FOR **
** STEP 12 PROGRAM 'SORTGL' ARE BASICALLY THE SAME AS FOR **
** STEP 5.  REQUEST TYPE -A- SORT INSTEAD OF TYPE -C- SORT **
```

Sample of Bank Reconciliation Run produced in Step 11 Program GL5

CNUMB VNUMB	MO	DY	DESCRIPTION	CHECKS OUTSTAND	CKSCASHED CHARGES	CKSNRIT/ CHARGES	DEPOSIT/ CREDITS	LEDGER BALANCE
	05	01	FST NAT'L BK-GEN					10,595.45
C0837	03	30	DEPT OF FIN		11.00-			
C0895	04	21	JC WHITNEY		74.92-			
C0900	04	25	ROADWAY EXP		20.17-			
C0903	04	27	CON POL TIC		25.00-			
C0904	04	27	DA SPARKS I		42.00-			
C0907	04	27	ENDERLIN NU		32.82-			
C0908	04	27	JACK YOUNG		117.29-			
C0909	04	27	NATL BOOK D		371.22-			
C0910	04	28	ERVIN EBSEN		44.28-			
C0912	05	03	KORDSMEIR P		2,151.38-	2,151.38-		2,151.38-
C0913	05	05	HW HALTER		350.00-	350.00-		350.00-
C0914	05	05	R HALTER		100.00-	100.00-		100.00-
C0915	05	05	FH HALTER E		350.00-	350.00-		350.00-
C0916	05	05	JD SHAMBURG		200.00-	200.00-		200.00-
C0917	05	01	MODERN SEC		10,711.75-	10,711.75-		10,711.75-
C0918	05	06	ERVIN EBSEN		49.45-	49.45-		49.45-
C0919	05	06	ROB SHAMBUR		30.00-	30.00-		30.00-
C0920	05	06	PAYROLL ACC		1,747.89-	1,747.89-		1,747.89-
C0921	05	06	BOWENS REST		1,194.44-	1,194.44-		1,194.44-
C0922	05	11	RAMADA INNS		919.05-	919.05-		919.05-
C0923	05	12	ROB SHAMBUR		15.00-	15.00-		15.00-
C0924	05	12	PAYROLL ACC		3,395.28-	3,395.28-		3,395.28-
C0925	05	12	ERVIN EBSEN		51.75-	51.75-		51.75-
C0926	05	16	IMP TRAVL S		16.80-	16.80-		16.80-
C0927	05	18	LAWRENCE CA		70.00-	70.00-		70.00-
C0928	05	18	RAMADA INNS		205.39-	205.39-		205.39-
C0929	05	17	RAMADA INNS		5.08-	5.08-		5.08-
C0930	05	18	DEPT OF FIN		690.96-	690.96-		690.96-
C0931	05	18	RADCO INN S		280.19-	280.19-		280.19-
C0932	05	19	JD SHAMBURG		350.00-	350.00-		350.00-
C0933	05	19	ZELLNER APP		52.38-	52.38-		52.38-
C0934	05	19	ARKLA		1,213.80-	1,213.80-		1,213.80-
C0935	05	19	PEPSI-COLA		122.85-	122.85-		122.85-
C0936	05	19	HAMMETT LAU		258.25-	258.25-		258.25-
C0937	05	19	UNIVERSAL F		87.80-	87.80-		87.80-
C0938	05	19	HEATH & CO		306.94-	306.94-		306.94-
C0939	05	19	HEATH & CO		239.48-	239.48-		239.48-
C0940	05	19	COCA-COLA		202.92-	202.92-		202.92-
C0941	05	19	BELL TELE C		1,712.20-	1,712.20-		1,712.20-
C0942	05	19	MOBIL OIL C		84.67-	84.67-		84.67-
C0943	05	19	MAULDING IN		70.04-	70.04-		70.04-
C0944	05	19	RCA		146.75-	146.75-		146.75-
C0945	05	19	MABHOLZ SUP		41.15-	41.15-		41.15-
C0946	05	19	LOG CABIN D		17.50-	17.50-		17.50-
C0947	05	19	CENTRL DAK		17.00-	17.00-		17.00-
C0948	05	19	CUERDEN SIG		266.44-	266.44-		266.44-
C0949	05	19	HEIGEL WHLS		71.59-	71.59-		71.59-
C0950	05	19	HIEGEL LUMB		202.56-	202.56-		202.56-
C0951	05	19	HAMBUCHEN E		197.47-	197.47-		197.47-
C0952	05	19	NATL BOOK D		259.59-	259.59-		259.59-
C0953	05	19	KANSAS CITY		397.58-	397.58-		397.58-
C0954	05	19	HANCO MFG C		191.27-	191.27-		191.27-
C0955	05	19	KANSAS CITY		697.31-	697.31-		697.31-
C0956	05	19	POOL CHEM I		672.02-	672.02-		672.02-
C0957	05	19	TERMINIX IN	25.00-		25.00-		25.00-
C0958	05	19	MAULDINS IN		59.40-	59.40-		59.40-
C0959	05	19	BELL TELE C		46.03-	46.03-		46.03-
C0960	05	19	ERVIN EBSEN		53.48-	53.48-		53.48-
C0961	05	19	ROB SHAMBUR	24.15-		24.15-		24.15-
C0962	05	20	PAYROLL ACC		1,910.66-	1,910.66-		1,910.66-
C0963	05	20	IMP TRVL SE	8.40-		8.40-		8.40-
C0964	05	24	BOWENS REST		2,185.59-	2,185.59-		2,185.59-
C0965	05	24	SEARS		680.00-	680.00-		680.00-
C0966	05	24	TEXACEO		18.20-	18.20-		18.20-
C0967	05	25	LAWRENCE CA		60.00-	60.00-		60.00-
C0968	05	25	MOVING - JD		470.00-	470.00-		470.00-
C0969	05	25	CONWAY CORP	2,312.76-		2,312.76-		2,312.76-
C0970	05	25	CONWAY CORP	88.68-		88.68-		88.68-
C0971	05	25	DA SPARKS I		42.00-	42.00-		42.00-
C0972	05	27	ERVIN EBSEN		52.90-	52.90-		52.90-
C0973	05	27	ROB SHAMBUR	25.00-		25.00-		25.00-
C0974	05	27	JPAYROLL AC		1,476.41-	1,476.41-		1,476.41-
V0501	05	01	BANK DEPOSI				400.53	400.53
V0502	05	02	BANK DEPOSI				2,012.19	2,012.19
V0503	05	03	BANK DEPOSI				1,033.51	1,033.51
V0504	05	04	BANK DEPOSI				569.10	569.10
V0505	05	05	BANK DEPOSI				1,398.74	1,398.74
V0506	05	06	BANK DEPOSI				1,687.19	1,687.19
V0507	05	07	BANK DEPOSI				882.89	882.89
V0508	05	08	BANK DEPOSI				659.69	659.69
V0509	05	09	BANK DEPOSI				1,555.14	1,555.14
V0510	05	10	BANK DEPOSI				960.86	960.86
V0511	05	11	BANK DEPOSI				519.83	519.83
V0512	05	12	BANK DEPOSI				874.51	874.51
V0513	05	13	BANK DEPOSI				1,128.40	1,128.40
V0514	05	14	BANK DEPOSI				1,035.68	1,035.68
V0515	05	15	BANK DEPOSI				1,257.22	1,257.22
V0516	05	16	BANK DEPOSI				1,561.17	1,561.17
V0517	05	17	BANK DEPOSI				763.85	763.85
V0518	05	18	BANK DEPOSI				491.58	491.58
V0519	05	19	BANK DEPOSI				1,196.01	1,196.01
V0520	05	20	BANK DEPOSI				4,082.06	4,082.06
V0521	05	21	BANK DEPOSI				1,544.46	1,544.46
V0522	05	22	BANK DEPOSI				625.77	625.77
V0523	05	23	BANK DEPOSI				594.48	594.48
V0524	05	24	BANK DEPOSI				512.75	512.75
V0525	05	25	BANK DEPOSI				744.97	744.97
V0526	05	26	BANK DEPOSI				835.93	835.93
V0527	05	27	BANK DEPOSI				1,833.89	1,833.89
V0528	05	28	BANK DEPOSI				494.87	494.87
V0529	05	29	BANK DEPOSI				1,625.96	1,625.96
V0530	05	30	BANK DEPOSI				1,117.52	1,117.52
V0531	05	31	BANK DEPOSI				3,348.53	3,348.53
V0532	05	09	TELE COMM				19.17	19.17
V0533	05	24	POP MACHINE				123.19	123.19
V0534	05	09	COKES				92.90	92.90
V0535	05	23	DEPOSIT				1,225.22	1,225.22
V0536	05	19	DEPOSIT				890.01	890.01
V0537	05	17	DEPOSIT				90.06	90.06
V0538	05	31	BANK		126.09-	126.09-		126.09-
V0539	05	06	DEPOSIT				42.28	42.28
V0544	05	04	DEPOSIT				1,300.00	1,300.00
V0545	05	02	DEPOSIT				500.00	500.00
			TOTALS	2,483.99-	38,293.45-	40,038.73-	41,633.13	12,189.85

```
BEG BANK BALANCE   12,346.30
CKSCASHED/CHARGES  38,293.45-
DEPOSITS/CREDITS   41,633.13
-----------------------------
END BANK BALANCE   15,685.98

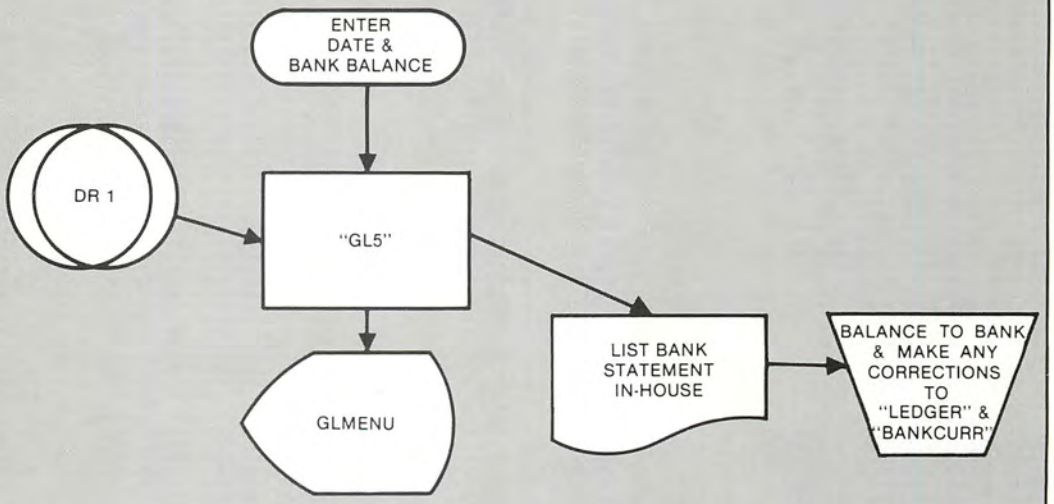
CHECKS OUTSTAND     2,483.99-
-----------------------------
BALANCE            13,201.99
LEDGER BALANCE     12,189.85
-----------------------------
DEPOSITS IN TRANS
LAST MONTH          1,012.14
```

Monthly Step #11 — Run Bank Statement for Account 1110 and Balance. Make Corrections to Ledger and Copy to Ledger Backup

FLOW DIAGRAM

STEP 11

PROGRAM "GL5"
"COPRAN"
"BANKCURR"



Terminal Inquiry Routine

```
ENTER -Y- TO MOUNT THE FILE? Y
BANKRECONCILLIATION: ACCOUNT# 1110
ENTER PERIOD ENDING DATE AS MO-DY-YR? 05-31-77
ENTER BANK'S BEGINNING BALANCE AS -XXXXX.XX? 12246.30
```

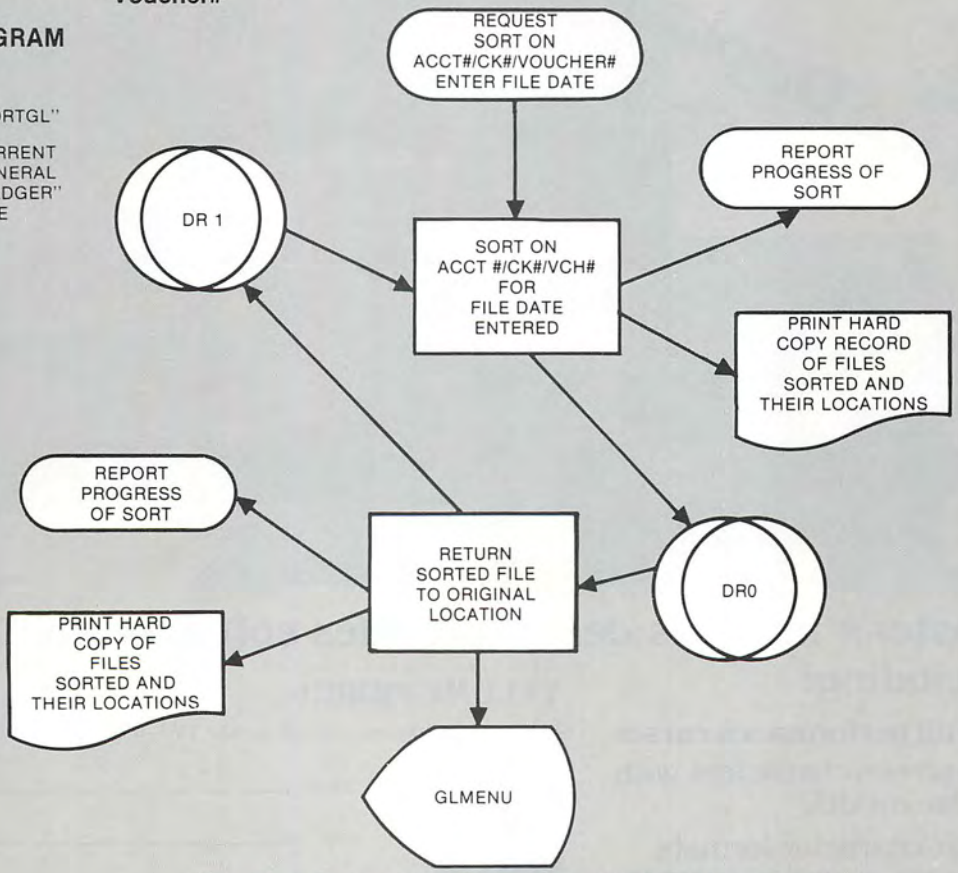
Monthly Step #12 — Sort Ledger by Account#/Check#/ Voucher#

FLOW DIAGRAM

STEP 12

PROGRAM "SORTGL"

CURRENT
GENERAL
"LEDGER"
FILE



The Terminal Inquiry Routines and line printer copy for Step 12 program SORTFL are basically the same as for Step 5. Request Type -A- sort instead of type -C- sort.

Sample of General Ledger run produced in Step 13 Program GL2

```
GENERAL LEDGER - UNAUDITED - PERIOD ENDING 05-31-77          PAGE  1

  DATE   ACCT CNUMB                          MONTHLY       MONTHLY       Y.T.D.
MO DY YR NUMB VNUMB DESCRIPTION              DEBITS        CREDITS       BALANCE
--------------------------------------------------------------------------------

ASSETS

CURRENT ASSETS
05-01-77 1101 CASH ON HAND                                                250.00
                ACCOUNT TOTAL                 0.00          0.00          250.00

05-01-77 1102 CHANGE FUND                                                  50.00
                ACCOUNT TOTAL                 0.00          0.00           50.00

05-01-77 1110 FST NAT'L BK-GENRL                                       10,595.45
05-03-77 1110 C0912 KORDSMEIR PLUMB                        2,151.38-    2,151.38-
05-05-77 1110 C0913 AW HALTER                                350.00-      350.00-
05-05-77 1110 C0914 R HALTER                                 100.00-      100.00-
05-05-77 1110 C0915 FW HALTER EST                            350.00-      350.00-
05-05-77 1110 C0916 JD SHAMBURGER                            200.00-      200.00-
05-01-77 1110 C0917 MODERN SEC LIFE                       10,711.75-   10,711.75-
05-06-77 1110 C0918 ERVIN EBSEN                               49.45-       49.45-
05-06-77 1110 C0919 ROB SHAMBURGER                            30.00-       30.00-
05-06-77 1110 C0920 PAYROLL ACCT                           1,747.89-    1,747.89-
05-06-77 1110 C0921 BOWENS REST                            1,194.44-    1,194.44-
05-11-77 1110 C0922 RAMADA INNS                              919.05-      919.05-
05-12-77 1110 C0923 ROB SHAMBURGER                            15.00-       15.00-
05-12-77 1110 C0924 PAYROLL ACCT                           3,395.28-    3,395.28-
05-12-77 1110 C0925 ERVIN EBSEN                               51.75-       51.75-
05-16-77 1110 C0926 IMP TRAVL SERV                            16.80-       16.80-
05-18-77 1110 C0927 LAWRENCE CARTER                           70.00-       70.00-
05-18-77 1110 C0928 RAMADA INNS                              205.39-      205.39-
05-17-77 1110 C0929 RAMADA INNS                                5.08-        5.08-
05-18-77 1110 C0930 DEPT OF FINANCE                          690.96-      690.96-
05-18-77 1110 C0931 RADCO INN SUPP                           280.19-      280.19-
05-19-77 1110 C0932 JD SHAMBURGER                            350.00-      350.00-
05-19-77 1110 C0933 ZELLNER APPL                              52.38-       52.38-
05-19-77 1110 C0934 ARKLA                                  1,213.80-    1,213.80-
05-19-77 1110 C0935 PEPSI-COLA                               122.85-      122.85-
05-19-77 1110 C0936 HAMMETT LAUNDRY                          258.25-      258.25-
05-19-77 1110 C0937 UNIVERSAL FENCE                           87.80-       87.80-
05-19-77 1110 C0938 HEATH & CO                               306.94-      306.94-
05-19-77 1110 C0939 HEATH & CO                               239.48-      239.48-
05-19-77 1110 C0940 COCA-COLA                                202.92-      202.92-
05-19-77 1110 C0941 BELL TELE CO                           1,712.20-    1,712.20-
05-19-77 1110 C0942 MOBIL OIL CO                              84.67-       84.67-
05-19-77 1110 C0943 MAULDING INC                              70.04-       70.04-
05-19-77 1110 C0944 RCA                                      146.75-      146.75-
05-19-77 1110 C0945 NABHOLZ SUPP                              41.15-       41.15-
05-19-77 1110 C0946 LOG CABIN DEM                             17.50-       17.50-
05-19-77 1110 C0947 CENTRL PAK DUST                           17.00-       17.00-
05-19-77 1110 C0948 CUERDEN SIGN CO                          266.44-      266.44-
05-19-77 1110 C0949 HEIGEL WHLSE                              71.59-       71.59-
05-19-77 1110 C0950 HIEGEL LUMBER                            202.56-      202.56-
05-19-77 1110 C0951 HAMBUCHEN ELEC                           197.47-      197.47-
05-19-77 1110 C0952 NATL BOOK DIST                           259.59-      259.59-
05-19-77 1110 C0953 KANSAS CITY WHT                          397.58-      397.58-
05-19-77 1110 C0954 HANCO MFG CO                             191.27-      191.27-
05-19-77 1110 C0955 KANSAS CITY WHT                          697.31-      697.31-
05-19-77 1110 C0956 POOL CHEM INC                            672.03-      672.03-
05-19-77 1110 C0957 TERMINIX INC                              25.00-       25.00-
05-19-77 1110 C0958 MAULDINS INC                              59.40-       59.40-
05-19-77 1110 C0959 BELL TELE CO                              46.02-       46.02-
05-19-77 1110 C0960 ERVIN EBSEN                               53.48-       53.48-
05-19-77 1110 C0961 ROB SHAMBURGER                            24.15-       24.15-
05-20-77 1110 C0962 PAYROLL ACCT                           1,910.66-    1,910.66-
05-20-77 1110 C0963 IMP TRVL SER                               8.40-        8.40-
05-24-77 1110 C0964 BOWENS REST                            2,185.59-    2,185.59-
05-24-77 1110 C0965 SEARS                                    680.00-      680.00-
05-24-77 1110 C0966 TEXACO                                    18.20-       18.20-
05-25-77 1110 C0967 LAWRENCE CARTER                           60.00-       60.00-
05-25-77 1110 C0968 MOVING - JDS                             430.00-      430.00-
05-25-77 1110 C0969 CONWAY CORP                            2,312.76-    2,312.76-
05-25-77 1110 C0970 CONWAY CORP                               88.68-       88.68-
05-25-77 1110 C0971 DA SPARKS INC                             42.00-       42.00-
05-27-77 1110 C0972 ERVIN EBSEN                               52.90-       52.90-
05-27-77 1110 C0973 ROB SHAMBURGER                            25.00-       25.00-
05-27-77 1110 C0974 JPAYROLL ACCT                          1,476.41-    1,476.41-
05-01-77 1110 V0501 BANK DEPOSIT              400.53                      400.53
05-02-77 1110 V0502 BANK DEPOSIT            2,012.19                    2,012.19
05-03-77 1110 V0503 BANK DEPOSIT            1,833.51                    1,833.51
05-04-77 1110 V0504 BANK DEPOSIT              569.10                      569.10
05-05-77 1110 V0505 BANK DEPOSIT            1,398.74                    1,398.74
05-06-77 1110 V0506 BANK DEPOSIT            1,687.19                    1,687.19
05-07-77 1110 V0507 BANK DEPOSIT              882.89                      882.89
05-08-77 1110 V0508 BANK DEPOSIT              659.69                      659.69
05-09-77 1110 V0509 BANK DEPOSIT            1,555.14                    1,555.14
05-10-77 1110 V0510 BANK DEPOSIT              960.86                      960.86
05-11-77 1110 V0511 BANK DEPOSIT              519.83                      519.83
05-12-77 1110 V0512 BANK DEPOSIT              874.51                      874.51
05-13-77 1110 V0513 BANK DEPOSIT            1,128.40                    1,128.40
05-14-77 1110 V0514 BANK DEPOSIT            1,035.68                    1,035.68
05-15-77 1110 V0515 BANK DEPOSIT            1,257.23                    1,257.23
05-16-77 1110 V0516 BANK DEPOSIT            1,561.17                    1,561.17
05-17-77 1110 V0517 BANK DEPOSIT              763.85                      763.85
05-18-77 1110 V0518 BANK DEPOSIT              491.58                      491.58
05-19-77 1110 V0519 BANK DEPOSIT            1,196.01                    1,196.01
05-20-77 1110 V0520 BANK DEPOSIT            4,083.06                    4,083.06
05-21-77 1110 V0521 BANK DEPOSIT            1,544.46                    1,544.46
05-22-77 1110 V0522 BANK DEPOSIT              625.77                      625.77
05-23-77 1110 V0523 BANK DEPOSIT              594.48                      594.48
05-24-77 1110 V0524 BANK DEPOSIT              512.75                      512.75
05-25-77 1110 V0525 BANK DEPOSIT              744.97                      744.97
05-26-77 1110 V0526 BANK DEPOSIT              835.93                      835.93
05-27-77 1110 V0527 BANK DEPOSIT            1,833.89                    1,833.89
05-28-77 1110 V0528 BANK DEPOSIT              494.87                      494.87
05-29-77 1110 V0529 BANK DEPOSIT            1,625.96                    1,625.96
05-30-77 1110 V0530 BANK DEPOSIT            1,117.53                    1,117.53
05-31-77 1110 V0531 BANK DEPOSIT            3,348.53                    3,348.53
05-09-77 1110 V0532 TELE COMM                  19.17                       19.17
05-24-77 1110 V0533 POP MACHINES              123.19                      123.19
05-09-77 1110 V0534 COKES                      92.90                       92.90
05-23-77 1110 V0535 DEPOSIT                 1,225.22                    1,225.22
05-19-77 1110 V0536 DEPOSIT                   890.01                      890.01
05-17-77 1110 V0537 DEPOSIT                    90.06                       90.06
05-31-77 1110 V0538 BANK                                   126.09-      126.09-
05-06-77 1110 V0539 DEPOSIT                   42.28                       42.28
05-04-77 1110 V0544 DEPOSIT                1,300.00                    1,300.00
05-02-77 1110 V0545 DEPOSIT                  500.00                      500.00
                ACCOUNT TOTAL             41,633.13     40,038.73-    12,189.85

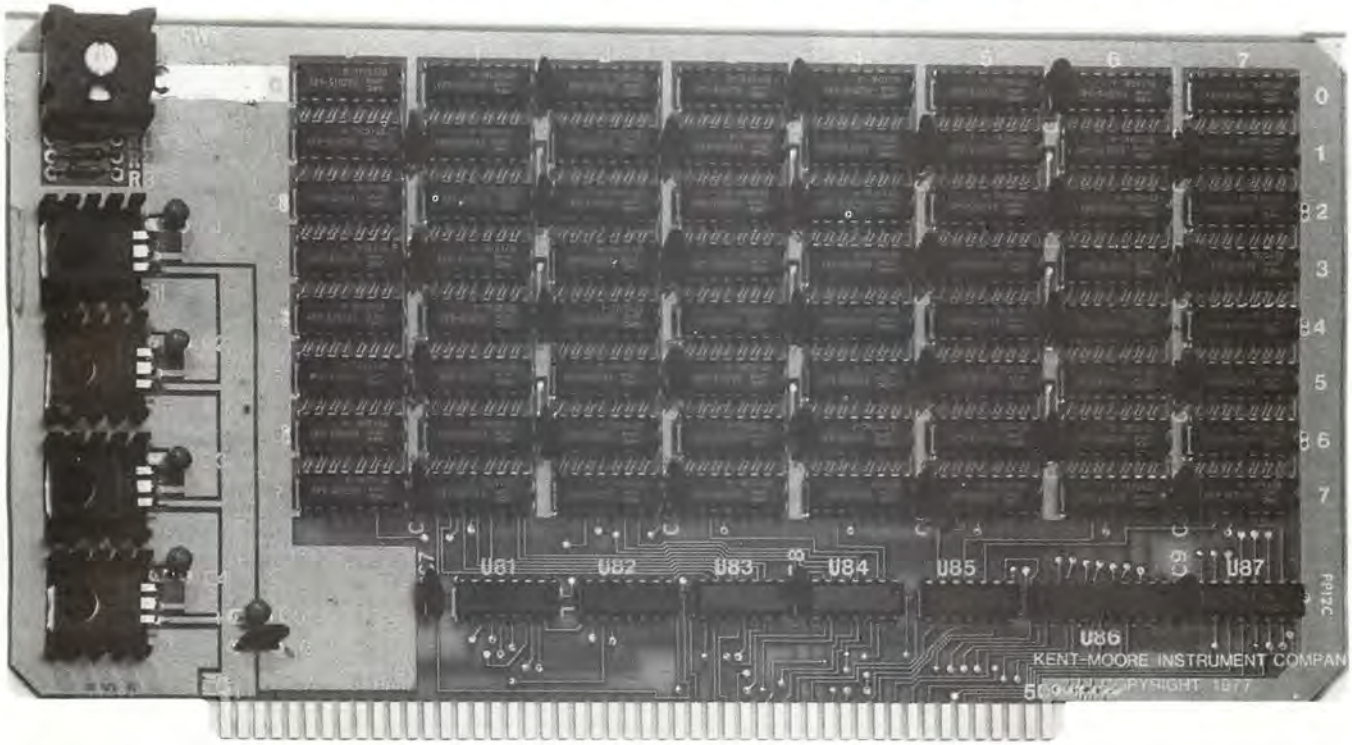
05-01-77 1111 FST NAT'L BK-PAYROLL                                      3,653.90
05-06-77 1111 C0920 PAYROLL ACCT            1,747.89                    1,747.89
05-12-77 1111 C0924 PAYROLL ACCT            3,395.28                    3,395.28
05-20-77 1111 C0962 PAYROLL ACCT            1,910.66                    1,910.66
05-27-77 1111 C0974 PAYROLL ACCT            1,476.41                    1,476.41
05-19-77 1111 V0540 PAYROLL                                1,672.73-    1,672.73-
05-23-77 1111 V0541 PAYROLL                                1,288.81-    1,288.81-
05-12-77 1111 V0542 PAYROLL                                2,994.03-    2,994.03-
05-06-77 1111 V0543 PAYROLL                                1,530.73-    1,530.73-
                ACCOUNT TOTAL             8,530.24      7,486.30-    4,697.84

05-01-77 1112 FST NAT'L BK-SAVINGS                                      4,865.56
                ACCOUNT TOTAL                 0.00          0.00      4,865.56

05-01-77 1113 CASH DEP MOD SEC LFE                                     21,423.50
                ACCOUNT TOTAL                 0.00          0.00     21,423.50

05-01-77 1129 ACCTS REC-CITY LEDGR                                      7,866.74
05-01-77 1129 V0501 CITY LEDGER               275.13                      275.13
05-02-77 1129 V0502 CITY LEDGER                56.48                       56.48
05-02-77 1129 V0502 CITY LEDGER                            1,590.13-    1,590.13-
05-02-77 1129 V0502 CR CARD DISC                               2.07-        2.07-
05-03-77 1129 V0503 CITY LEDGER               174.30                      174.30
```

MORE BYTES FOR YOUR BUCK !



8K RAM...assembled, burnt-in, tested and warranted...only $197.50!

These are not kits, but completely assembled and tested boards, with a 1 year warranty. No soldering, no messing, no chance of mis-connections . . . just plug 'em in and you're ready to run. The 8K RAM has the same features and speed as our 4K RAM (500 nsec, no wait states) and if that isn't fast enough there's our 8K (Z) fast RAM that gives you a 250 nsec access time for only $217.50!

Because of the low power memory chips used, power requirements are lower than many other RAM boards. And the 8K RAM uses less power than two 4K boards. All RAMs are manufactured to military specification MIL STD-883-C, assuring greatest control over reliability.

Address selection is easily accomplished by our Visaddress™, an easy to read switch on the board top. The 8K board is designed to be selected as one of eight possible 8K RAM boards present on the S-100 bus.

To achieve address selection, the top address lines are decoded using the Visaddress switch. The switch will then show the selected starting address of the RAM card. (i.e. ø=øøøø—1FFF, 2=2øøø-3FFF, etc. on the 8K board).

Both boards have fully buffered address and data lines, and extensive built-in noise immunity circuitry. And are plug-in compatible with the S-100 bus (Altair 8800, IMSA1 8080, etc.)

Quality, assembled boards at less than kit prices. But what else should you expect from a company whose prime products are electronic test instrumentation and microprocessing components?

Also available: 4K RAM; $107.00, Alpha-VDM; $107.00, Alpha-VDM-II; $145.00, Graphics-VDM; $137.00.

Order direct by check, BankAmericard or Master Charge (Add $1.50 shipping, credit customers give us all the card numbers, please and Ohio residents add 4½% sales tax) or contact us for more information. Kent-Moore Instrument Company, a subsidiary of Kent-Moore Corporation (founded in 1919), P.O. Box 507, Industrial Ave., Pioneer, Ohio 43554. (419) 737-2352. Or, Kent-Moore of Canada, 246 S. Cawthra Rd., Mississauga, Ontario L-A3P2, Canada.

Kent-Moore
INSTRUMENT COMPANY

CIRCLE INQUIRY NO. 21

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05-04-77 1129 V0504 CITY LEDGER                          38.78-      38.78-
05-04-77 1129 V0504 CITY LEDGER          377.32                      377.32
05-05-77 1129 V0505 CR CARD DISC                         35.14-      35.14-
05-05-77 1129 V0505 CITY LEDGER          373.46                      373.46
05-05-77 1129 V0505 CITY LEDGER                       1,066.75-   1,066.75-
05-06-77 1129 V0506 CITY LEDGER        1,029.04                    1,029.04
05-07-77 1129 V0507 CITY LEDGER          426.54                      426.54
05-08-77 1129 V0508 CITY LEDGER          336.46                      336.46
05-09-77 1129 V0509 CR CARD DISC                         28.15-      28.15-
05-09-77 1129 V0509 CITY LEDGER                         975.81-     975.81-
05-09-77 1129 V0509 CITY LEDGER          154.25                      154.25
05-10-77 1129 V0510 CITY LEDGER                         145.90-     145.90-
05-10-77 1129 V0510 CR CARD DISC                          7.68-       7.68-
05-10-77 1129 V0510 CITY LEDGER          196.86                      196.86
05-11-77 1129 V0511 CR CARD DISC                          1.21-       1.21-
05-11-77 1129 V0511 CITY LEDGER          559.88                      559.88
05-11-77 1129 V0511 CITY LEDGER                          28.93-      28.93-
05-12-77 1129 V0512 CITY LEDGER          420.20                      420.20
05-13-77 1129 V0513 CITY LEDGER          657.10                      657.10
05-13-77 1129 V0513 CITY LEDGER                         317.77-     317.77-
05-13-77 1129 V0513 CR CARD DISC                         10.45-      10.45-
05-14-77 1129 V0514 CITY LEDGER          553.65                      553.65
05-15-77 1129 V0515 CITY LEDGER          449.67                      449.67
05-16-77 1129 V0516 CR CARD DISC                         35.24-      35.24-
05-16-77 1129 V0516 CITY LEDGER                       1,235.05-   1,235.05-
05-16-77 1129 V0516 CITY LEDGER          222.20                      222.20
05-17-77 1129 V0517 CITY LEDGER          203.79                      203.79
05-18-77 1129 V0518 CITY LEDGER          299.24                      299.24
05-19-77 1129 V0519 CITY LEDGER                         256.75-     256.75-
05-19-77 1129 V0519 CITY LEDGER          748.21                      748.21
05-20-77 1129 V0520 CITY LEDGER                       2,345.98-   2,345.98-
05-20-77 1129 V0520 CR CARD DISC                         71.30-      71.30-
05-20-77 1129 V0520 CITY LEDGER          666.62                      666.62
05-21-77 1129 V0521 CITY LEDGER          965.32                      965.32
05-22-77 1129 V0522 CITY LEDGER           94.76                       94.76
05-23-77 1129 V0523 CITY LEDGER                         147.85-     147.85-
05-23-77 1129 V0523 CITY LEDGER          184.07                      184.07
05-23-77 1129 V0523 CR CARD DISC                          4.10-       4.10-
05-24-77 1129 V0524 CITY LEDGER          141.79                      141.79
05-25-77 1129 V0525 CITY LEDGER          425.41                      425.41
05-26-77 1129 V0526 CITY LEDGER          594.77                      594.77
05-27-77 1129 V0527 CITY LEDGER          612.81                      612.81
05-27-77 1129 V0527 CR CARD DISC                         24.08-      24.08-
05-27-77 1129 V0527 CITY LEDGER                         457.52-     457.52-
05-28-77 1129 V0528 CITY LEDGER        1,188.78                    1,188.78
05-29-77 1129 V0529 CITY LEDGER        1,011.52                    1,011.52
05-30-77 1129 V0530 CITY LEDGER                         179.33-     179.33-
05-30-77 1129 V0530 CITY LEDGER          208.69                      208.69
05-31-77 1129 V0531 CITY LEDGER          147.41                      147.41
05-31-77 1129 V0531 CR CARD DISC                         95.02-      95.02-
05-31-77 1129 V0531 CITY LEDGER                       2,822.75-   2,822.75-
05-31-77 1129 V0547 BAD ACCOUNTS                        639.24-     639.24-
                 ACCOUNT TOTAL          13,755.74   12,562.98-    9,059.50

05-01-77 1130 ACCTS REC-REGULAR                                     684.05
05-01-77 1130 V0501 ACCTS REC                            675.66-     675.66-
05-01-77 1130 V0501 ACCTS REC            558.74                      558.74
05-02-77 1130 V0502 ACCTS REC                            478.54-     478.54-
05-02-77 1130 V0502 ACCTS REC          1,407.78                    1,407.78
05-02-77 1130 V0503 ACCTS REC          1,377.16                    1,377.16
05-02-77 1130 V0503 ACCTS REC                         1,207.81-   1,207.81-
05-04-77 1130 V0504 ACCTS REC                           907.64-     907.64-
05-04-77 1130 V0504 ACCTS REC          1,653.13                    1,653.13
05-05-77 1130 V0505 ACCTS REC          1,570.16                    1,570.16
05-05-77 1130 V0505 ACCTS REC                           705.45-     705.45-
05-06-77 1130 V0506 ACCTS REC                         2,716.23-   2,716.23-
05-06-77 1130 V0506 ACCTS REC          1,241.20                    1,241.20
05-07-77 1130 V0507 ACCTS REC                         1,309.43-   1,309.43-
05-07-77 1130 V0507 ACCTS REC          1,104.36                    1,104.36
05-08-77 1130 V0508 ACCTS REC                           996.15-     996.15-
05-08-77 1130 V0508 ACCTS REC            681.93                      681.93
05-09-77 1130 V0509 ACCTS REC                           733.58-     733.58-
05-09-77 1130 V0509 ACCTS REC          1,181.01                    1,181.01
05-10-77 1130 V0510 ACCTS REC                         1,011.82-   1,011.82-
05-10-77 1130 V0510 ACCTS REC          1,298.47                    1,298.47
05-11-77 1130 V0511 ACCTS REC                         1,050.78-   1,050.78-
05-11-77 1130 V0511 ACCTS REC          1,661.65                    1,661.65
05-12-77 1130 V0512 ACCTS REC          1,410.88                    1,410.88
05-12-77 1130 V0512 ACCTS REC                         1,294.71-   1,294.71-
05-13-77 1130 V0513 ACCTS REC          1,566.99                    1,566.99
05-13-77 1130 V0513 ACCTS REC                         1,467.73-   1,467.73-
05-14-77 1130 V0514 ACCTS REC                         1,589.33-   1,589.33-
05-14-77 1130 V0514 ACCTS REC          1,185.24                    1,185.24
05-15-77 1130 V0515 ACCTS REC                         1,706.90-   1,706.90-
05-15-77 1130 V0515 ACCTS REC            666.07                      666.07
05-16-77 1130 V0516 ACCTS REC                           548.32-     548.32-
05-16-77 1130 V0516 ACCTS REC          1,526.86                    1,526.86
05-17-77 1130 V0517 ACCTS REC          1,649.43                    1,649.43
05-17-77 1130 V0517 ACCTS REC                           967.64-     967.64-
05-18-77 1130 V0518 ACCTS REC                           790.82-     790.82-
05-18-77 1130 V0518 ACCTS REC          1,471.63                    1,471.63
05-19-77 1130 V0519 ACCTS REC                         1,687.47-   1,687.47-
05-19-77 1130 V0519 ACCTS REC          1,567.92                    1,567.92
05-20-77 1130 V0520 ACCTS REC          1,717.54                    1,717.54
05-20-77 1130 V0520 ACCTS REC                         2,403.71-   2,403.71-
05-21-77 1130 V0521 ACCTS REC                         2,589.78-   2,589.78-
05-21-77 1130 V0521 ACCTS REC            788.22                      788.22
05-22-77 1130 V0522 ACCTS REC            529.31                      529.31
05-22-77 1130 V0522 ACCTS REC                           720.53-     720.53-
05-22-77 1130 V0522 ACCTS REC                           630.70-     630.70-
05-23-77 1130 V0523 ACCTS REC          1,469.16                    1,469.16
05-24-77 1130 V0524 ACCTS REC                           654.54-     654.54-
05-24-77 1130 V0524 ACCTS REC          1,552.52                    1,552.52
05-25-77 1130 V0525 ACCTS REC                         1,170.38-   1,170.38-
05-25-77 1130 V0525 ACCTS REC          1,680.71                    1,680.71
05-26-77 1130 V0526 ACCTS REC                         1,430.70-   1,430.70-
05-26-77 1130 V0526 ACCTS REC          1,197.31                    1,197.31
05-27-77 1130 V0527 ACCTS REC          1,797.17                    1,797.17
05-27-77 1130 V0527 ACCTS REC                         1,989.18-   1,989.18-
05-28-77 1130 V0528 ACCTS REC          1,933.13                    1,933.13
05-28-77 1130 V0528 ACCTS REC                         1,683.65-   1,683.65-
05-29-77 1130 V0529 ACCTS REC          1,032.37                    1,032.37
05-29-77 1130 V0529 ACCTS REC                         2,637.48-   2,637.48-
05-30-77 1130 V0530 ACCTS REC            838.02                      838.02
05-30-77 1130 V0530 ACCTS REC                         1,146.89-   1,146.89-
05-31-77 1130 V0531 ACCTS REC                           672.19-     672.19-
05-31-77 1130 V0531 ACCTS REC          1,562.00                    1,562.00
                 ACCOUNT TOTAL        40,888.07   39,496.74-    2,075.38

05-01-77 1134 PREPAID INSURANCE                                   2,614.64
                 ACCOUNT TOTAL             0.00        0.00     2,614.64

05-01-77 1136 PREPAID PROP TAXES                                  7,500.00
                 ACCOUNT TOTAL             0.00        0.00     7,500.00

                 TOTAL CURRENT ASSETS  104,807.18   99,584.75-   64,726.27

FIXED ASSETS
05-01-77 1201 BUILDINGS-MTL-REST                                1,089,509.00
                 ACCOUNT TOTAL             0.00        0.00  1,089,509.00

05-01-77 1202 ACC DEPR-BUILDINGS                                  156,528.37-
05-31-77 1202       DEPR MONTHLY                                    3,520.67-
                 ACCOUNT TOTAL             0.00        0.00    160,049.04-

05-01-77 1205 FURN-FIXT-& CARPETS                                  95,987.00
                 ACCOUNT TOTAL             0.00        0.00     95,987.00

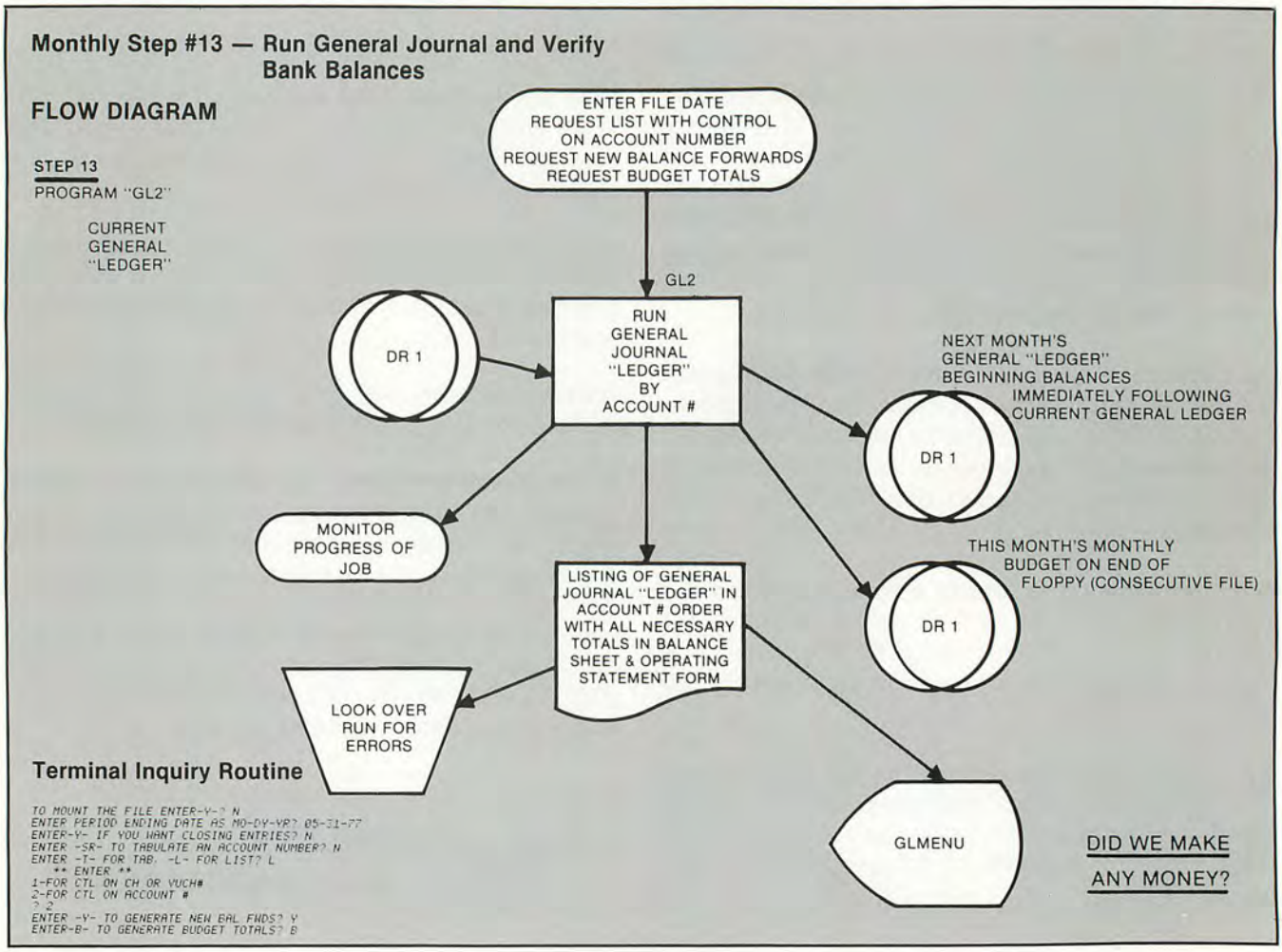
05-01-77 1206 ACC DEPR-FURN-FIX-CR                                 74,025.25-
05-31-77 1206       DEPR MONTHLY                                    1,681.75-
                 ACCOUNT TOTAL             0.00        0.00     75,707.00-

05-01-77 1213 LAND IMPROVEMENTS                                   112,713.00
                 ACCOUNT TOTAL             0.00        0.00    112,713.00

05-01-77 1214 ACC DEPR-LAND IMPROV                                 21,194.63-
```

Monthly Step #13 — Run General Journal and Verify Bank Balances

FLOW DIAGRAM



Terminal Inquiry Routine

```
TO MOUNT THE FILE ENTER-Y-? N
ENTER PERIOD ENDING DATE AS MO-DY-YR? 05-31-77
ENTER-Y- IF YOU WANT CLOSING ENTRIES? N
ENTER -SR- TO TABULATE AN ACCOUNT NUMBER? N
ENTER -T- FOR TAB, -L- FOR LIST? L
   ** ENTER **
1-FOR CTL ON CH OR VUCH#
2-FOR CTL ON ACCOUNT #
 ? 2
ENTER -Y- TO GENERATE NEW BAL FWDS? Y
ENTER-B- TO GENERATE BUDGET TOTALS? B
```

05-31-77 1214	DEPR MONTHLY		345.33-	345.33-
	ACCOUNT TOTAL	0.00	345.33-	21,539.96-
05-01-77 1223	SWIMMING POOL			26,695.00
	ACCOUNT TOTAL	0.00	0.00	26,695.00
05-01-77 1224	ACC DEPR SWIM POOL			2,748.87-
05-31-77 1224	DEPR MONTHLY		165.17-	165.17-
	ACCOUNT TOTAL	0.00	165.17-	2,914.04-
05-01-77 1227	OFFICE FURN & FIXT			4,970.00
	ACCOUNT TOTAL	0.00	0.00	4,970.00
05-01-77 1228	ACC DEPR OFFICE FURN			3,517.00-
05-31-77 1228	DEPR MONTHLY		108.00-	108.00-
	ACCOUNT TOTAL	0.00	108.00-	3,625.00-
	TOTAL FIXED ASSETS	0.00	5,820.92-	1,066,038.96
OTHER ASSETS				
05-01-77 1301	RAMADA FRANCHISE			12,500.00
	ACCOUNT TOTAL	0.00	0.00	12,500.00
05-01-77 1302	ESCROW DEPOSIT			0.00
	ACCOUNT TOTAL	0.00	0.00	0.00
05-01-77 1303	UTILITY DEPOSITS			50.00
	ACCOUNT TOTAL	0.00	0.00	50.00
05-01-77 1304	ORGANIZATION COST			4,250.00
	ACCOUNT TOTAL	0.00	0.00	4,250.00
	TOTAL OTHER ASSETS	0.00	0.00	16,800.00
	TOTAL ASSETS	104,807.18	105,405.67-	1,147,565.23

DATE MO DY YR	ACCT NUMB VNUMB	DESCRIPTION	MONTHLY DEBITS	MONTHLY CREDITS	Y T D BALANCE
LIABILITIES					
CURRENT LIABILITIES					
05-01-77	2100	ACCOUNTS PAYABLE			0.00
05-31-77	2100 V0546	UNPAID TAXES		4,842.82-	4,842.82-
		ACCOUNT TOTAL	0.00	4,842.82-	4,842.82-
05-01-77	2109	STATE W-H TAX PAYABL			66.54-
05-19-77	2109 V0540	SIT		5.14-	5.14-
05-20-77	2109 V0541	SIT		4.71-	4.71-
05-12-77	2109 V0542	SIT		4.36-	4.36-
05-06-77	2109 V0543	SIT		4.36-	4.36-
		ACCOUNT TOTAL	0.00	18.57-	85.11-
05-01-77	2110	FED W-H TAX PAYABLE			294.70-
05-19-77	2110 V0540	FIT		21.60-	21.60-
05-20-77	2110 V0541	FIT		19.70-	19.70-
05-12-77	2110 V0542	FIT		21.60-	21.60-
05-06-77	2110 V0543	FIT		19.60-	19.60-
		ACCOUNT TOTAL	0.00	82.50-	377.20-
05-01-77	2111	ACCRUED FICA TAXES			1,378.13-
05-19-77	2111 V0540	FICA		105.60-	105.60-
05-20-77	2111 V0541	FICA		81.59-	81.59-
05-12-77	2111 V0542	FICA		187.63-	187.63-
05-06-77	2111 V0543	FICA		96.60-	96.60-
		ACCOUNT TOTAL	0.00	471.42-	1,849.55-
05-01-77	2123	NOTE-PAY MODERN SEC			16,766.59-
		ACCOUNT TOTAL	0.00	0.00	16,766.59-
05-01-77	2134	DUE BOWENS RESTAURANT			531.56
05-06-77	2134 C0921	BOWENS REST	1,194.44		1,194.44
05-24-77	2134 C0964	BOWENS REST	2,185.59		2,185.59
05-01-77	2134 V0501	DUE BOWENS		89.43-	89.43-
05-02-77	2134 V0502	DUE BOWENS		87.92-	87.92-
05-03-77	2134 V0503	DUE BOWENS		100.84-	100.84-
05-04-77	2134 V0504	DUE BOWENS		288.52-	288.52-
05-05-77	2134 V0505	DUE BOWENS		125.10-	125.10-
05-06-77	2134 V0506	DUE BOWENS		146.51-	146.51-
05-07-77	2134 V0507	DUE BOWENS		43.51-	43.51-
05-08-77	2134 V0508	DUE BOWENS		139.72-	139.72-
05-09-77	2134 V0509	DUE BOWENS		69.92-	69.92-
05-10-77	2134 V0510	DUE BOWENS		207.68-	207.68-
05-11-77	2134 V0511	DUE BOWENS		278.77-	278.77-
05-12-77	2134 V0512	DUE BOWENS		169.54-	169.54-
05-13-77	2134 V0513	DUE BOWENS		151.89-	151.89-
05-14-77	2134 V0514	DUE BOWENS		159.47-	159.47-
05-15-77	2134 V0515	DUE BOWENS		126.76-	126.76-
05-16-77	2134 V0516	DUE BOWENS		117.00-	117.00-
05-17-77	2134 V0517	DUE BOWENS		167.98-	167.98-
05-18-77	2134 V0518	DUE BOWENS		114.21-	114.21-
05-19-77	2134 V0519	DUE BOWENS		146.67-	146.67-
05-20-77	2134 V0520	DUE BOWENS		165.47-	165.47-
05-21-77	2134 V0521	DUE BOWENS		46.83-	46.83-
05-22-77	2134 V0522	DUE BOWENS		38.65-	38.65-
05-23-77	2134 V0523	DUE BOWENS		171.31-	171.31-
05-24-77	2134 V0524	DUE BOWENS		153.95-	153.95-
05-25-77	2134 V0525	DUE BOWENS		149.66-	149.66-
05-26-77	2134 V0526	DUE BOWENS		88.26-	88.26-
05-27-77	2134 V0527	DUE BOWENS		135.01-	135.01-
05-28-77	2134 V0528	DUE BOWENS		156.24-	156.24-
05-29-77	2134 V0529	DUE BOWENS		154.40-	154.40-
05-30-77	2134 V0530	DUE BOWENS		97.98-	97.98-
05-31-77	2134 V0531	DUE BOWENS		209.38-	209.38-
05-31-77	2134 V0547	DUE BOWENS	86.34		86.34
		ACCOUNT TOTAL	3,466.37	4,260.59-	262.66-
		TOTAL CURRENT LIAB	3,466.37	9,675.90-	24,182.93-
NON-CURRENT LIAB					
05-01-77	2200	NOTEPAY MOD SEC LONG			1,077,875.35-
05-01-77	2200 C0917	MODERN SEC LIFE	1,614.81		1,614.81
		ACCOUNT TOTAL	1,614.81	0.00	1,076,260.54-
		TOT NON-CURR LIAB	1,614.81	0.00	1,076,260.54-
		TOTAL LIABILITIES	5,081.18	9,675.90-	1,100,444.47-
EQUITY					
05-01-77	3000	CAPITAL STOCK			92,793.21-
		ACCOUNT TOTAL	0.00	0.00	92,793.21-
05-01-77	3001	UNDISTRIBUT TAX INC			0.00
		ACCOUNT TOTAL	0.00	0.00	0.00
05-01-77	3002	UNDISTRIBUT TAX INC			1,241.31-
		ACCOUNT TOTAL	0.00	0.00	1,241.31-
05-01-77	3096	CURRENT EARNINGS			32,710.55
05-21-77	3096	CURRENT EARNING	5,193.21		5,193.21
		ACCOUNT TOTAL	5,193.21	0.00	37,903.76
		TOTAL EQUITY	5,193.21	0.00	47,120.76-
		TOT LIAB & EQUITY	5,193.21	0.00	1,147,565.23-
		NET	115,081.57	115,081.57-	0.00

05-01-77 4100 ROOM SALES			307,629.39-
05-01-77 4100 V0501 ROOM RENT		427.00-	427.00-
05-02-77 4100 V0502 ROOM RENT		1,189.00-	1,189.00-
05-02-77 4100 V0503 ROOM RENT		1,134.00-	1,134.00-
05-04-77 4100 V0504 ROOM RENT		1,203.90-	1,203.90-
05-05-77 4100 V0505 ROOM RENT		1,210.00-	1,210.00-
05-06-77 4100 V0506 ROOM RENT		1,010.90-	1,010.90-
05-07-77 4100 V0507 ROOM RENT		976.00-	976.00-
05-08-77 4100 V0508 ROOM RENT		443.40-	443.40-
05-09-77 4100 V0509 ROOM RENT		904.50-	904.50-
05-10-77 4100 V0510 ROOM RENT		949.50-	949.50-
05-11-77 4100 V0511 ROOM RENT		1,220.00-	1,220.00-
05-12-77 4100 V0512 ROOM RENT		1,084.00-	1,084.00-
05-13-77 4100 V0513 ROOM RENT		1,302.50-	1,302.50-
05-14-77 4100 V0514 ROOM RENT		940.50-	940.50-
05-15-77 4100 V0515 ROOM RENT		492.00-	492.00-
05-16-77 4100 V0516 ROOM RENT		1,270.80-	1,270.80-
05-17-77 4100 V0517 ROOM RENT		1,319.00-	1,319.00-
05-18-77 4100 V0518 ROOM RENT		1,155.00-	1,155.00-
05-19-77 4100 V0519 ROOM RENT		1,305.00-	1,305.00-
05-20-77 4100 V0520 ROOM RENT		1,455.00-	1,455.00-
05-21-77 4100 V0521 ROOM RENT		692.00-	692.00-
05-22-77 4100 V0522 ROOM RENT		473.00-	473.00-
05-23-77 4100 V0523 ROOM RENT		1,142.00-	1,142.00-
05-24-77 4100 V0524 ROOM RENT		1,299.00-	1,299.00-
05-25-77 4100 V0525 ROOM RENT		1,352.00-	1,352.00-
05-26-77 4100 V0526 ROOM RENT		962.00-	962.00-
05-27-77 4100 V0527 ROOM RENT		1,571.00-	1,571.00-
05-28-77 4100 V0528 ROOM RENT		1,663.00-	1,663.00-
05-29-77 4100 V0529 ROOM RENT		809.00-	809.00-
05-30-77 4100 V0530 ROOM RENT		692.00-	692.00-
05-31-77 4100 V0531 ROOM RENT		1,220.00-	1,220.00-
05-31-77 4100 V0547 ROOM RENT	457.50		457.50
ACCOUNT TOTAL	457.50	32,890.00-	340,061.89-
05-01-77 4101 MEETING ROOM SALES			2,779.45-
05-02-77 4101 V0502 MEETING ROOM		25.00-	25.00-
05-09-77 4101 V0509 MEETING ROOM		25.00-	25.00-
05-11-77 4101 V0511 MEETING ROOM		25.00-	25.00-
05-16-77 4101 V0516 MEETING ROOM		25.00-	25.00-
05-23-77 4101 V0523 MEETING ROOM		25.00-	25.00-
05-25-77 4101 V0525 MEETING ROOM		15.00-	15.00-
ACCOUNT TOTAL	0.00	140.00-	2,919.45-
05-01-77 4102 TELEPHONE SALES LONG			14,517.45-
05-01-77 4102 V0501 TELEPHONE		17.64-	17.64-
05-02-77 4102 V0502 TELEPHONE		49.07-	49.07-
05-03-77 4102 V0503 TELEPHONE		84.41-	84.41-
05-04-77 4102 V0504 TELEPHONE		106.19-	106.19-
05-05-77 4102 V0505 TELEPHONE		111.36-	111.36-
05-06-77 4102 V0506 TELEPHONE		40.02-	40.02-
05-07-77 4102 V0507 TELEPHONE		48.07-	48.07-
05-08-77 4102 V0508 TELEPHONE		73.82-	73.82-
05-09-77 4102 V0509 TELEPHONE		64.47-	64.47-
05-10-77 4102 V0510 TELEPHONE		51.20-	51.20-
05-11-77 4102 V0511 TELEPHONE		69.42-	69.42-
05-12-77 4102 V0512 TELEPHONE		84.02-	84.02-
05-13-77 4102 V0513 TELEPHONE		60.19-	60.19-
05-14-77 4102 V0514 TELEPHONE		51.27-	51.27-
05-15-77 4102 V0515 TELEPHONE		22.68-	22.68-
05-16-77 4102 V0516 TELEPHONE		57.25-	57.25-
05-17-77 4102 V0517 TELEPHONE		91.93-	91.93-
05-18-77 4102 V0518 TELEPHONE		133.34-	133.34-
05-19-77 4102 V0519 TELEPHONE		71.16-	71.16-
05-20-77 4102 V0520 TELEPHONE		43.06-	43.06-
05-21-77 4102 V0521 TELEPHONE		11.19-	11.19-
05-22-77 4102 V0522 TELEPHONE		11.71-	11.71-
05-23-77 4102 V0523 TELEPHONE		113.95-	113.95-
05-24-77 4102 V0524 TELEPHONE		58.34-	58.34-
05-25-77 4102 V0525 TELEPHONE		95.36-	95.36-
05-26-77 4102 V0526 TELEPHONE		98.16-	98.16-
05-27-77 4102 V0527 TELEPHONE		29.09-	29.09-
05-28-77 4102 V0528 TELEPHONE		32.31-	32.31-
05-29-77 4102 V0529 TELEPHONE		24.81-	24.81-
05-30-77 4102 V0530 TELEPHONE		22.95-	22.95-
05-31-77 4102 V0531 TELEPHONE		63.92-	63.92-
05-31-77 4102 V0547 PHONE	80.65		80.65
ACCOUNT TOTAL	80.65	1,894.47-	16,331.27-
TOT RM TEL MT ROOM	538.15	34,924.47-	359,312.61-
MISC SALES			
05-01-77 4200 TELEPHONE PAY STATON			129.40-
05-09-77 4200 V0532 TELE COMM		19.17-	19.17-
ACCOUNT TOTAL	0.00	19.17-	148.57-
05-01-77 4201 RESTAURANT RENTAL			14,200.00-
05-04-77 4201 V0544 BOWENS LEASE		1,300.00-	1,300.00-
ACCOUNT TOTAL	0.00	1,300.00-	15,600.00-
05-01-77 4203 SERVICE STATION RENT			5,500.00-
05-02-77 4203 V0545 MOBIL LEASE		500.00-	500.00-
ACCOUNT TOTAL	0.00	500.00-	6,000.00-
05-01-77 4204 SALES TAX			48.54
05-18-77 4204 C0930 DEPT OF FINAC	690.96		690.96
05-01-77 4204 V0501 SALES TAX		12.81-	12.81-
05-02-77 4204 V0502 SALES TAX		25.67-	25.67-
05-03-77 4204 V0503 SALES TAX		24.02-	24.02-
05-04-77 4204 V0504 SALES TAX		36.14-	36.14-
05-05-77 4204 V0505 SALES TAX		36.32-	36.32-
05-06-77 4204 V0506 SALES TAX		30.33-	30.33-
05-07-77 4204 V0507 SALES TAX		29.28-	29.28-
05-08-77 4204 V0508 SALES TAX		13.31-	13.31-
05-09-77 4204 V0509 SALES TAX		27.14-	27.14-
05-10-77 4204 V0510 SALES TAX		28.07-	28.07-
05-11-77 4204 V0511 SALES TAX		36.99-	36.99-
05-12-77 4204 V0512 SALES TAX		32.61-	32.61-
05-13-77 4204 V0513 SALES TAX		39.16-	39.16-
05-14-77 4204 V0514 SALES TAX		28.21-	28.21-
05-15-77 4204 V0515 SALES TAX		14.79-	14.79-
05-16-77 4204 V0516 SALES TAX		37.56-	37.56-
05-17-77 4204 V0517 SALES TAX		39.64-	39.64-
05-18-77 4204 V0518 SALES TAX		34.72-	34.72-
05-19-77 4204 V0519 SALES TAX		39.21-	39.21-
05-20-77 4204 V0520 SALES TAX		43.65-	43.65-
05-21-77 4204 V0521 SALES TAX		21.42-	21.42-
05-22-77 4204 V0522 SALES TAX		14.19-	14.19-
05-23-77 4204 V0523 SALES TAX		34.32-	34.32-
05-24-77 4204 V0524 SALES TAX		39.02-	39.02-
05-25-77 4204 V0525 SALES TAX		40.72-	40.72-
05-26-77 4204 V0526 SALES TAX		28.95-	28.95-
05-27-77 4204 V0527 SALES TAX		47.13-	47.13-
05-28-77 4204 V0528 SALES TAX		49.89-	49.89-
05-29-77 4204 V0529 SALES TAX		24.27-	24.27-
05-30-77 4204 V0530 SALES TAX		20.76-	20.76-
05-31-77 4204 V0531 SALES TAX		36.91-	36.91-
05-31-77 4204 V0547 TAX	14.75		14.75
ACCOUNT TOTAL	705.71	987.34-	233.09-
05-01-77 4205 BOWEN REST CR DISC			1,287.97-
05-27-77 4205 V0535 BOWENS CR DISC		108.97-	108.97-
ACCOUNT TOTAL	0.00	108.97-	1,392.94-
05-01-77 4206 INTEREST INCOME			319.11-
ACCOUNT TOTAL	0.00	0.00	319.11-
05-01-77 4207 MISC INCOME			236.68-
ACCOUNT TOTAL	0.00	0.00	236.68-
TOTAL MISC SALES	705.71	2,915.48-	23,930.39-
SALES-OTHER			
05-01-77 4300 GAME MACHINE			652.36-
05-17-77 4300 V0537 GAME MACHINE		37.25-	37.25-
ACCOUNT TOTAL	0.00	37.25-	689.61-
05-01-77 4301 GUEST LAUNDRY-VALET			1,109.87-
05-02-77 4301 V0502 VALET		7.30-	7.30-
05-04-77 4301 V0504 VALET		2.25-	2.25-
05-05-77 4301 V0505 VALET		73.90-	73.90-
05-06-77 4301 V0506 VALET		4.25-	4.25-
05-09-77 4301 V0509 VALET		51.35-	51.35-
05-10-77 4301 V0510 VALET		10.00-	10.00-
05-13-77 4301 V0513 VALET		5.00-	5.00-
05-17-77 4301 V0517 VALET		7.35-	7.35-
05-18-77 4301 V0518 VALET		23.45-	23.45-
05-25-77 4301 V0525 VALET		5.50-	5.50-
05-26-77 4301 V0526 VALET		9.63-	9.63-
ACCOUNT TOTAL	0.00	199.98-	1,309.85-
05-01-77 4302 MAGAZINES & SUNDRIES			4,603.75-
05-01-77 4302 V0501 NEWSSTAND		11.86-	11.86-
05-02-77 4302 V0502 NEWSSTAND		13.82-	13.82-
05-03-77 4302 V0503 NEWSSTAND		22.88-	22.88-
05-04-77 4302 V0504 NEWSSTAND		16.12-	16.12-
05-05-77 4302 V0505 NEWSSTAND		12.48-	12.48-
05-06-77 4302 V0506 NEWSSTAND		9.19-	9.19-
05-07-77 4302 V0507 NEWSSTAND		7.50-	7.50-
05-08-77 4302 V0508 NEWSSTAND		11.68-	11.68-
05-09-77 4302 V0509 NEWSSTAND		38.62-	38.62-
05-10-77 4302 V0510 NEWSSTAND		52.02-	52.02-
05-11-77 4302 V0511 NEWSSTAND		21.47-	21.47-
05-12-77 4302 V0512 NEWSSTAND		40.70-	40.70-
05-13-77 4302 V0513 NEWSSTAND		8.25-	8.25-
05-14-77 4302 V0514 NEWSSTAND		5.69-	5.69-
05-15-77 4302 V0515 NEWSSTAND		7.84-	7.84-
05-16-77 4302 V0516 NEWSSTAND		19.15-	19.15-
05-17-77 4302 V0517 NEWSSTAND		23.52-	23.52-
05-18-77 4302 V0518 NEWSSTAND		10.91-	10.91-
05-19-77 4302 V0519 NEWSSTAND		5.88-	5.88-
05-20-77 4302 V0520 NEWSSTAND		10.36-	10.36-
05-21-77 4302 V0521 NEWSSTAND		15.78-	15.78-
05-22-77 4302 V0522 NEWSSTAND		1.76-	1.76-
05-23-77 4302 V0523 NEWSSTAND		20.58-	20.58-
05-24-77 4302 V0524 NEWSSTAND		2.20-	2.20-
05-25-77 4302 V0525 NEWSSTAND		22.46-	22.46-
05-26-77 4302 V0526 NEWSSTAND		9.31-	9.31-
05-27-77 4302 V0527 NEWSSTAND		14.94-	14.94-
05-28-77 4302 V0528 NEWSSTAND		30.69-	30.69-
05-29-77 4302 V0529 NEWSSTAND		19.89-	19.89-
05-30-77 4302 V0530 NEWSSTAND		4.33-	4.33-
05-31-77 4302 V0531 NEWSSTAND		21.79-	21.79-
ACCOUNT TOTAL	0.00	515.69-	5,119.44-
05-01-77 4303 CIGARETTE MACHINES			229.32-
05-06-77 4303 V0539 CIG MACHINE		21.60-	21.60-
ACCOUNT TOTAL	0.00	21.60-	250.92-
05-01-77 4304 POP MACHINES			3,340.51-
05-24-77 4304 V0532 POP MACHINES		123.19-	123.19-
05-09-77 4304 V0534 COKES		92.90-	92.90-
05-17-77 4304 V0537 POP MACHINE		52.81-	52.81-
ACCOUNT TOTAL	0.00	268.90-	3,609.41-
05-01-77 4305 COPY MACHINE			124.50-
ACCOUNT TOTAL	0.00	0.00	124.50-
05-01-77 4306 CANDY-CONV MACHINES			295.99-
05-06-77 4306 V0539 CANDY		20.68-	20.68-
ACCOUNT TOTAL	0.00	20.68-	316.67-
TOTAL SALES OTHER	0.00	1,064.10-	11,420.40-
TOTAL INCOME	1,243.86	38,904.05-	394,663.40-

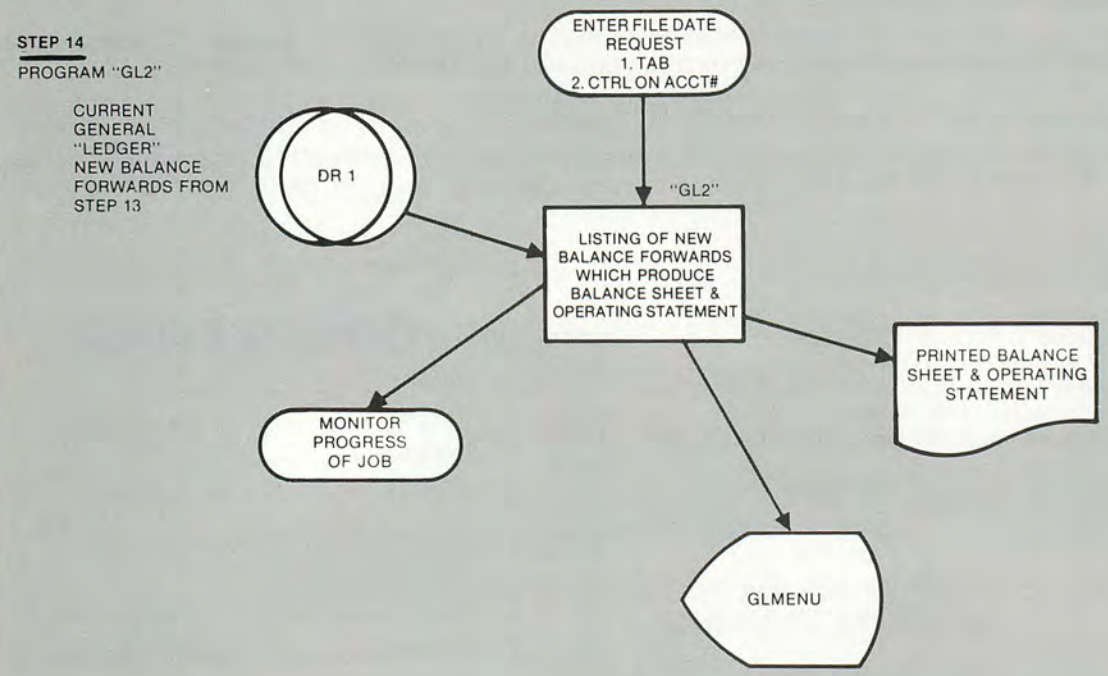
DATE ACCT CNUMB MO DY YR NUMB VNUMB DESCRIPTION	MONTHLY DEBITS	MONTHLY CREDITS	Y. T. D. BALANCE
EXPENSES			
COST OF ROOM SALES			
05-01-77 7100 GEN MGR BONUS			24,990.95
05-19-77 7100 V0540 GEN MGR	750.00		750.00
05-23-77 7100 V0541 GEN MGR	375.00		375.00
05-12-77 7100 V0542 GEN MGR	2,250.00		2,250.00
05-06-77 7100 V0543 GEN MGR	750.00		750.00
ACCOUNT TOTAL	4,125.00	0.00	29,115.95
05-01-77 7101 NIGHT AUDITORS-PAYRL			18,614.34
05-19-77 7101 V0540 CLERKS & AUDITOR	367.49		367.49
05-23-77 7101 V0541 CLERKS & AUDITOR	350.63		350.63
05-12-77 7101 V0542 CLERKS & AUDITOR	324.68		324.68
05-06-77 7101 V0543 CLERKS & AUDITOR	316.01		316.01
ACCOUNT TOTAL	1,358.81	0.00	19,973.15
05-01-77 7102 HOUSEKEEPER-PAYROLL			2,438.00
05-19-77 7102 V0540 HOUSEKEEPER	53.00		53.00
05-23-77 7102 V0541 HOUSEKEEPTER	53.00		53.00
05-12-77 7102 V0542 HOUSEKEEPER	53.00		53.00
05-06-77 7102 V0543 HOUSEKEEPER	53.00		53.00
ACCOUNT TOTAL	212.00	0.00	2,650.00
05-01-77 7103 LINEN PERSONS			2,137.80
05-19-77 7103 V0540 LINEN BOYS	52.45		52.45
05-23-77 7103 V0541 LINEN BOYS	53.00		53.00
05-12-77 7103 V0542 LINEN BOYS	47.00		47.00
05-06-77 7103 V0543 LINEN BOYS	52.92		52.92
ACCOUNT TOTAL	205.37	0.00	2,343.17
05-01-77 7104 MAIDS-PAYROLL			19,789.46
05-19-77 7104 V0540 MAIDS	374.84		374.84
05-23-77 7104 V0541 MAIDS	374.83		374.83
05-12-77 7104 V0542 MAIDS	356.14		356.14
05-06-77 7104 V0543 MAIDS	317.85		317.85
ACCOUNT TOTAL	1,423.66	0.00	21,213.12
05-01-77 7105 LAUNDRY-PAYROLL			4,315.52
05-19-77 7105 V0540 LAUNDRY	171.06		171.06
05-23-77 7105 V0541 LAUNDRY	159.60		159.60
05-12-77 7105 V0542 LAUNDRY	134.25		134.25
05-06-77 7105 V0543 LAUNDRY	121.26		121.26
ACCOUNT TOTAL	586.17	0.00	4,901.70
05-01-77 7106 LINEN EXPENSE			4,268.86
05-19-77 7106 C0953 KANSAS CITY WHT	297.58		297.58
05-19-77 7106 C0955 KANSAS CITY WHT	697.31		697.31
ACCOUNT TOTAL	1,094.89	0.00	5,263.75
05-01-77 7107 GUEST SUPPLIES			4,049.95
05-19-77 7107 C0931 RADCO INN SUPP	280.19		280.19
05-19-77 7107 C0949 HEIGEL WHLSE	71.59		71.59
ACCOUNT TOTAL	751.78	0.00	4,401.73
05-01-77 7108 CLEANING SUPPLIES			1,290.54
05-19-77 7108 C0954 HANCO MFG CO	191.27		191.27
ACCOUNT TOTAL	191.27	0.00	1,481.81
05-01-77 7109 LAUNDRY SUPPLIES			1,133.66
ACCOUNT TOTAL	0.00	0.00	1,133.66
05-01-77 7110 MISC EXPENSE			552.52
05-19-77 7110 C0947 CENTRL HPL DUST	17.00		17.00
ACCOUNT TOTAL	17.00	0.00	569.52
05-01-77 7111 PEST CONTROLL			275.00
05-19-77 7111 C0957 TERMINIX INC	25.00		25.00
ACCOUNT TOTAL	25.00	0.00	300.00
05-01-77 7112 TRAVEL AGENCY COMM			94.80
05-16-77 7112 C0926 IMP TRAVL SERV	16.80		16.80
05-19-77 7112 C0928 RAMADA INNS	21.60		21.60
05-20-77 7112 C0962 EMP TRVL SER	8.40		8.40
ACCOUNT TOTAL	46.80	0.00	141.60

05-01-77 7113 UNIFORMS				136.56
ACCOUNT TOTAL	0.00		0.00	136.56
05-01-77 7114 GEN MGR PAYROLL				1,093.75
ACCOUNT TOTAL	0.00		0.00	1,093.75
05-01-77 7115 BELLMEN-PAYROLL				242.00
ACCOUNT TOTAL	0.00		0.00	242.00
05-01-77 7116 SECURITY GUARD SERV				0.00
05-18-77 7116 C0927 LAWRENCE CARTER	70.00			70.00
05-25-77 7116 C0967 LAWRENCE CARTER	60.00			60.00
ACCOUNT TOTAL	130.00		0.00	130.00
TOT COST ROOM SALES	9,767.75		0.00	95,191.47
COST OF TELEPHONE SERVICE				
05-01-77 7200 LOST OF LONG DIST SR				10,546.64
05-19-77 7200 C0941 BELL TELE CO	924.19			924.19
ACCOUNT TOTAL	924.19		0.00	11,470.83
05-01-77 7201 SWITCHBOARD RENT				6,750.12
05-19-77 7201 C0941 BELL TELE CO	629.06			629.06
ACCOUNT TOTAL	629.06		0.00	7,379.18
05-01-77 7202 MISCELLANEOUS EXP				1,630.98
05-19-77 7202 C0941 BELL TELE CO	158.95			158.95
ACCOUNT TOTAL	158.95		0.00	1,789.93
TOT COST OF TEL SER	1,712.20		0.00	20,639.94
COST OF OTHER SALES				
05-01-77 7300 GUEST LAUNDRY-VALET				996.29
05-19-77 7300 C0936 HAMMETT LAUNDRY	258.25			258.25
ACCOUNT TOTAL	258.25		0.00	1,254.54
05-01-77 7301 MAGAZ & SUNDRY EXP				7,393.66
05-19-77 7301 C0952 NATL BOOK DIST	259.59			259.59
ACCOUNT TOTAL	259.59		0.00	7,653.25
05-01-77 7302 POP MACHINES EXP				1,189.55
05-19-77 7302 C0935 PEPSI-COLA	122.85			122.85
05-19-77 7302 C0940 COCA-COLA	202.92			202.92
ACCOUNT TOTAL	325.77		0.00	1,514.72
05-01-77 7303 MISCELLANEOUS EXP				0.00
ACCOUNT TOTAL	0.00		0.00	0.00
05-01-77 7304 COPY MACHINE EXP				771.76
05-25-77 7304 C0971 DH SPARKS INC	42.00			42.00
ACCOUNT TOTAL	42.00		0.00	813.76
TOT COST OF OTH SALE	885.61		0.00	9,275.97
GENERAL & ADMINISTRATIVE EXP				
05-01-77 7400 CREDIT CARD DISC				4,983.93
05-02-77 7400 V0502 CR CARD DISC	2.07			2.07
05-05-77 7400 V0505 CR CARD DISC	18.14			18.14
05-09-77 7400 V0509 CR CARD DISC	28.15			28.15
05-10-77 7400 V0510 CR CARD DISC	7.66			7.66
05-11-77 7400 V0511 CR CARD DISC	1.21			1.21
05-13-77 7400 V0513 CR CARD DISC	10.45			10.45
05-16-77 7400 V0516 CR CARD DISC	15.24			15.24
05-20-77 7400 V0520 CR CARD DISC	71.30			71.30
05-23-77 7400 V0523 CR CARD DISC	4.10			4.10
05-27-77 7400 V0527 CR CARD DISC	24.08			24.08
05-31-77 7400 V0531 CR CARD DISC	95.02			95.02
05-31-77 7400 V0528 CR CD DISCOUNTS	126.09			126.09
ACCOUNT TOTAL	440.52		0.00	5,324.46
05-01-77 7402 DUES & SUBSCRIPTION				425.00
ACCOUNT TOTAL	0.00		0.00	425.00
05-01-77 7403 LAND LEASE				8,300.00
05-05-77 7403 C0913 AW HALTER	250.00			250.00
05-05-77 7403 C0914 R HALTER	100.00			100.00
05-05-77 7403 C0915 FN HALTER EST	250.00			250.00
ACCOUNT TOTAL	800.00		0.00	9,600.00
05-01-77 7404 MISCELLANEOUS				270.14
ACCOUNT TOTAL	0.00		0.00	270.14
05-01-77 7405 OFFICE SUPPLIES				2,152.32
ACCOUNT TOTAL	0.00		0.00	2,152.32
05-01-77 7406 POSTAGE				132.15
ACCOUNT TOTAL	0.00		0.00	132.15
05-01-77 7407 PROFESSIONAL SERV				10,285.09
ACCOUNT TOTAL	0.00		0.00	10,285.09
05-01-77 7408 INTEREST EXPENSE				91,759.47
05-01-77 7408 C0917 MODERN SEC LIFE	9,096.94			9,096.94
ACCOUNT TOTAL	9,096.94		0.00	100,856.41
05-01-77 7409 ROYALTY PAYMENTS				7,780.57
05-11-77 7409 C0922 RAMADA INNS	587.55			587.55
ACCOUNT TOTAL	587.55		0.00	8,368.12
05-01-77 7410 TELEPHONE & TELE				524.15
05-19-77 7410 C0959 BELL TELE CO	46.02			46.02
ACCOUNT TOTAL	46.02		0.00	570.18
05-01-77 7411 TRAVEL-MOVING EXP				3,226.96
05-05-77 7411 C0916 JD SHAMBURGER	200.00			200.00
05-13-77 7411 C0942 MOBIL OIL CO	84.67			84.67
05-24-77 7411 C0966 TEXACO	18.20			18.20
05-25-77 7411 C0968 MOVING - JDS	430.00			430.00
ACCOUNT TOTAL	732.87		0.00	3,959.83
05-01-77 7412 PAYROLL TAXES				6,088.05
ACCOUNT TOTAL	0.00		0.00	6,088.05
05-01-77 7413 BAD DEBTS				184.62
ACCOUNT TOTAL	0.00		0.00	184.62
05-01-77 7414 FREIGHT & STORAGE				372.95
05-17-77 7414 C0929 RAMADA INNS	5.08			5.08
ACCOUNT TOTAL	5.08		0.00	378.03
05-01-77 7415 CASH OVER & SHORT				144.17
ACCOUNT TOTAL	0.00		0.00	144.17
05-01-77 7416 NCR MAINTANENCE AGRE				148.06
ACCOUNT TOTAL	0.00		0.00	148.06
05-01-77 7417 RINA-TRAINING FEES				70.20
05-11-77 7417 C0922 RAMADA INNS	23.40			23.40
ACCOUNT TOTAL	23.40		0.00	93.60
05-01-77 7418 COMPUTER SERVICES-JS				2,800.00
05-19-77 7418 C0932 JD SHAMBURGER	350.00			350.00
ACCOUNT TOTAL	350.00		0.00	3,150.00
TOT GEN & ADM EXP	12,882.40		0.00	152,331.19
ADVERTISING & PROMOTION				
05-01-77 7500 MISCELLANEOUS				1,054.82
ACCOUNT TOTAL	0.00		0.00	1,054.82
05-01-77 7501 NATIONAL ADV FUND				3,510.00
05-11-77 7501 C0922 RAMADA INNS	308.10			308.10
ACCOUNT TOTAL	308.10		0.00	3,818.10
05-01-77 7502 NEWSPAPERS & MAGAZIN				165.50
05-19-77 7502 C0946 LOG CABIN DEM	17.50			17.50
ACCOUNT TOTAL	17.50		0.00	183.00
05-01-77 7503 BILLBOARDS				3,070.62

05-19-77 7503 C0948 CUERDEN SIGN CO	266.44		266.44
ACCOUNT TOTAL	266.44	0.00	1,337.06
05-01-77 7504 ON PREMISES SIGNS			5,993.26
05-19-77 7504 C0938 HEATH & CO	306.94		306.94
05-19-77 7504 C0939 HEATH & CO	239.48		239.48
ACCOUNT TOTAL	546.42	0.00	6,539.68
TOT ADV & PROMOTION	1,138.46	0.00	14,922.66
REPAIRS & MAINTENANCE			
05-01-77 7600 CONTRACT LABOR-OTHER			2,137.25
05-06-77 7600 C0918 ERVIN EBSEN	49.45		49.45
05-12-77 7600 C0925 ERVIN EBSEN	51.75		51.75
05-19-77 7600 C0960 ERVIN EBSEN	53.48		53.48
05-27-77 7600 C0972 ERVIN EBSEN	52.90		52.90
ACCOUNT TOTAL	207.58	0.00	2,344.84
05-01-77 7601 CONTRACT LABOR-POB			615.00
05-06-77 7601 C0913 POB SHAMBURGER	30.00		30.00
05-12-77 7601 C0922 POB SHAMBURGER	15.00		15.00
05-19-77 7601 C0961 POB SHAMBURGER	24.15		24.15
05-27-77 7601 C0973 POB SHAMBURGER	25.00		25.00
ACCOUNT TOTAL	94.15	0.00	709.15
05-01-77 7602 PAYROLL-FAM-JIM			1,702.50
05-19-77 7602 V0540 MAINTANENCE	36.22		36.22
05-23-77 7602 V0541 MAINTNANCE	28.75		28.75
05-12-77 7602 V0542 MAINTANENCE	42.55		42.55
05-06-77 7602 V0543 MAINTNANCE	40.25		40.25
ACCOUNT TOTAL	147.79	0.00	1,950.29
05-01-77 7603 AIR COND & HEATING			668.78
05-19-77 7603 C0942 MAULDINS INC	70.04		70.04
05-19-77 7603 C0958 MAULDINS INC	59.40		59.40
ACCOUNT TOTAL	129.44	0.00	798.22
05-01-77 7604 BUILDINGS			2,142.04
ACCOUNT TOTAL	0.00	0.00	2,142.04
05-01-77 7605 CONTRACT SERVICES			500.00
ACCOUNT TOTAL	0.00	0.00	500.00
05-01-77 7606 ELECTRICAL & MECHAN			2,352.61
05-19-77 7606 C0951 HAMBUCHEN ELEC	197.47		197.47
ACCOUNT TOTAL	197.47	0.00	2,550.08
05-01-77 7607 FURNISHINGS			569.87
05-19-77 7607 C0945 NAEHOLZ SUPP	41.15		41.15
ACCOUNT TOTAL	41.15	0.00	611.02
05-01-77 7608 LAUNDRY			675.78
ACCOUNT TOTAL	0.00	0.00	675.78
05-01-77 7609 MISCELLANEOUS			269.43
ACCOUNT TOTAL	0.00	0.00	269.43
05-01-77 7610 PAINTING & DECORATNG			82.94
ACCOUNT TOTAL	0.00	0.00	82.94
05-01-77 7611 PLUMBING			221.06
05-01-77 7611 C0912 KORDSMEIR PLUMB	2,151.39		2,151.39
05-12-77 7611 C0950 HIEGELLUMBER	202.56		202.56
05-19-77 7611 V0536 BOWENS HALF		890.01-	890.01-
ACCOUNT TOTAL	2,352.94	890.01-	1,684.00
05-01-77 7612 POOL			2,637.26
05-19-77 7612 C0956 POOL CHEM INC	672.03		672.03
ACCOUNT TOTAL	672.03	0.00	3,309.29
05-01-77 7613 T.V. LEASE			1,614.25
05-19-77 7613 C0944 RCA	146.75		146.75
ACCOUNT TOTAL	146.75	0.00	1,761.00
05-01-77 7614 T.V. NON-LEASE			905.77
05-19-77 7614 C0927 ZELLNER APPL	52.38		52.38
ACCOUNT TOTAL	52.38	0.00	958.11
05-01-77 7615 PAYROLL-OUTSIDE			720.70
ACCOUNT TOTAL	0.00	0.00	720.70
05-01-77 7616 GROUNDS MAINTANENCE			217.62
05-19-77 7616 C0937 UNIVERSAL FENCE	87.80		87.80
05-24-77 7616 C0965 SEARS	680.00		680.00
ACCOUNT TOTAL	767.80	0.00	1,001.42
TOT REPAIRS & MAINT	4,810.47	890.01-	22,529.10
UTILITIES			
05-01-77 7700 ELECTRICITY			10,740.62
05-25-77 7700 C0969 CONWAY CORP	2,151.01		2,151.01
05-23-77 7700 V0525 BOWENS ELECTRIC		1,116.25-	1,116.25-
ACCOUNT TOTAL	2,151.01	1,116.25-	11,775.38
05-01-77 7701 NATURAL GAS			10,271.17
05-19-77 7701 C0924 ARKLA	1,213.80		1,213.80
ACCOUNT TOTAL	1,213.80	0.00	11,484.97
05-01-77 7702 SEWER & GARBAGE			448.00
05-25-77 7702 C0969 CONWAY CORP	64.00		64.00
05-25-77 7702 C0970 CONWAY CORP	88.68		88.68
ACCOUNT TOTAL	152.68	0.00	600.68
05-01-77 7703 WATER			1,116.67
05-25-77 7703 C0963 CONWAY CORP	97.75		97.75
ACCOUNT TOTAL	97.75	0.00	1,214.42
TOTAL UTILITIES	3,615.24	1,116.25-	25,095.46
RESERVATION EXP			
05-01-77 7800 RESERVATION FEES			3,071.48
ACCOUNT TOTAL	0.00	0.00	3,071.48
05-01-77 7801 RAMADA TERMINAL			2,420.22
05-18-77 7801 C0928 RAMADA INNS	183.79		183.79
ACCOUNT TOTAL	183.79	0.00	2,604.01
TOT RESERVATION EXP	183.79	0.00	5,675.49
INSURANCE, TAXES & DEPRECIATION			
05-01-77 7900 WORKMENS COMP INS			2,344.00
ACCOUNT TOTAL	0.00	0.00	2,344.00
05-01-77 7901 GENERAL INS EXP			2,922.00
ACCOUNT TOTAL	0.00	0.00	2,922.00
05-01-77 7902 PROPERTY TAXES			5,386.00
05-31-77 7902 V0546 UNPAID TAXES	4,842.82		4,842.82
ACCOUNT TOTAL	4,842.82	0.00	10,228.82
05-01-77 7903 DEPRECIATION EXP			64,070.12
05-31-77 7903 DEPR MONTHLY	5,820.92		5,820.92
ACCOUNT TOTAL	5,820.92	0.00	69,851.04
05-01-77 7904 MORTGAGE INS			289.92
ACCOUNT TOTAL	0.00	0.00	289.92
TOT INS TAX & DEPR	10,663.74	0.00	86,625.78
TOTAL EXPENSES	44,859.66	2,006.26-	432,567.16
PROFIT(-) OR LOSS(+)	46,103.52	40,910.31-	37,907.76

Monthly Step #14 — Run Balance Sheet and Operating Statement

FLOW DIAGRAM



Terminal Inquiry Routine

```
TO MOUNT THE FILE ENTER-Y-? N
ENTER PERIOD ENDING DATE AS MO-DY-YR? 05-31-77
ENTER-Y- IF YOU WANT CLOSING ENTRIES? N
   ** ENTER **
1-FOR CTL ON CH OR VUCH#
2-FOR CTL ON ACCOUNT #
? 2
```

Sample of Balance Sheet run produced in Step 14 program GL2

BALANCE SHEET - UNAUDITED - PERIOD ENDING 05-31-77

DATE MO DY YR	ACCT CNUMB VNUMB	DESCRIPTION	MONTHLY DEBITS	MONTHLY CREDITS	Y. T. D. BALANCE
		ASSETS			
		CURRENT ASSETS			
06-01-77	1101	CASH ON HAND			250.00
06-01-77	1102	CHANGE FUND			50.00
06-01-77	1110	FST NAT'L BK-GENRL			12,189.85
06-01-77	1111	FST NAT'L BK-PAYROLL			4,697.84
06-01-77	1112	FST NAT'L BK-SAVINGS			4,865.56
06-01-77	1113	CASH DEP MOD SEC LFE			21,422.50
06-01-77	1129	ACCTS REC-CITY LEDGR			9,059.50
06-01-77	1130	ACCTS REC-REGULAR			2,075.38
06-01-77	1134	PREPAID INSURANCE			2,614.64
06-01-77	1136	PREPAID PROP TAXES			7,500.00
		TOTAL CURRENT ASSETS	0.00	0.00	64,726.27
		FIXED ASSETS			
06-01-77	1201	BUILDINGS-MTL-REST			1,039,503.00
06-01-77	1202	ACC DEPR-BUILDINGS			160,049.04-
06-01-77	1205	FURN-FIXT-& CRPPETS			95,987.00
06-01-77	1206	ACC DEPR-FURN-FIX-CR			75,707.00-
06-01-77	1213	LAND IMPROVEMENTS			112,713.00
06-01-77	1214	ACC DEPR-LAND IMPROV			21,539.96-
06-01-77	1223	SWIMMING POOL			26,695.00
06-01-77	1224	ACC DEPR SWIM POOL			2,914.04-
06-01-77	1227	OFFICE FURN & FIXT			4,970.00
06-01-77	1228	ACC DEPR OFFICE FURN			3,625.00-
		TOTAL FIXED ASSETS	0.00	0.00	1,066,038.96
		OTHER ASSETS			
06-01-77	1301	KAMADA FRANCHISE			12,500.00
06-01-77	1302	ESCROW DEPOSIT			0.00
06-01-77	1303	UTILITY DEPOSITS			50.00
06-01-77	1304	ORGANIZATION COST			4,250.00
		TOTAL OTHER ASSETS	0.00	0.00	16,800.00
		TOTAL ASSETS	0.00	0.00	1,147,565.23

DATE MO DY YR	ACCT CNUMB VNUMB	DESCRIPTION	MONTHLY DEBITS	MONTHLY CREDITS	Y. T. D. BALANCE
		LIABILITIES			
		CURRENT LIABILITIES			
06-01-77	2100	ACCOUNTS PAYABLE			4,842.82-
06-01-77	2109	STATE W-H TAX PAYABL			85.11-
06-01-77	2110	FED W-H TAX PAYABLE			377.20-
06-01-77	2111	ACCRUED FICA TAXES			1,849.55-
06-01-77	2133	NOTE-PAY MODERN SEC			16,766.59-
06-01-77	2134	DUE BOWEN RESTAURANT			262.66-
		TOTAL CURRENT LIAB	0.00	0.00	24,183.93-
		NON-CURRENT LIAB			
06-01-77	2200	NOTEPAY MOD SEC LONG			1,076,260.54-
		TOT NON-CURR LIAB	0.00	0.00	1,076,260.54-
		TOTAL LIABILITIES	0.00	0.00	1,100,444.47-
		EQUITY			
06-01-77	3000	CAPITAL STOCK			83,783.21-
06-01-77	3001	UNDISTRIBUT TAX INC			0.00
06-01-77	3002	UNDISTRIBUT TAX INC			1,241.31-
06-01-77	3096	CURRENT EARNINGS			37,903.76
		TOTAL EQUITY	0.00	0.00	47,120.76-
		TOT LIAB & EQUITY	0.00	0.00	1,147,565.23-
		NET	0.00	0.00	0.00

OPERATING STATEMENT - UNAUDITED - PERIOD ENDING 05-31-77

DATE MO DY YR	ACCT CNUMB VNUMB	DESCRIPTION	MONTHLY DEBITS	MONTHLY CREDITS	Y. T. D. BALANCE
		INCOME			
		ROOM-MEETING & TELEPHONE			
06-01-77	4100	ROOM SALES			340,061.89-
06-01-77	4101	MEETING ROOM SALES			2,919.45-
06-01-77	4102	TELEPHONE SALES LONG			16,331.27-
		TOT RM.TEL.MT ROOM	0.00	0.00	359,312.61-
		MISC SALES			
06-01-77	4200	TELEPHONE PAY STATON			148.57-
06-01-77	4201	RESTAURANT RENTAL			15,600.00-
06-01-77	4203	SERVICE STATION RENT			6,000.00-
06-01-77	4204	SALES TAX			233.09-
06-01-77	4205	BOWEN REST CR DISC			1,392.94-
06-01-77	4206	INTEREST INCOME			319.11-
06-01-77	4207	MISC INCOME			236.69-
		TOTAL MISC SALES	0.00	0.00	23,930.39-
		SALES-OTHER			
06-01-77	4300	GAME MACHINE			689.61-
06-01-77	4301	GUEST LAUNDRY-VALET			1,309.85-
06-01-77	4302	MAGAZINES & SUNDRIES			5,119.44-
06-01-77	4303	CIGARETTE MACHINES			250.92-
06-01-77	4304	POP MACHINES			3,609.41-
06-01-77	4305	COPY MACHINE			124.50-
06-01-77	4306	CANDY-CONV MACHINES			316.67-
		TOTAL SALES OTHER	0.00	0.00	11,420.40-
		TOTAL INCOME	0.00	0.00	394,663.40-

the Processor Terminal.

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the **Processor Terminal.** A new design by **TEI** and look at what you get . . . a complete, self contained microcomputer system with display and mass storage, a full keyboard and plenty of slot space for additional boards. And that famous **TEI CVT** power supply that makes brownouts a thing of the past.

Display — A 15" high-resolution black and white video display with an optical filter face plate to reduce glare and improve type visability . . . **Keyboard** — Full upper and lower case ASCII detached keyboard with 8 programmable special function keys. Keyboard status indicators show computer BUSY or READY. And a 16-key numeric cluster pad set up calculator style . . . **Disk Drive & Controller** — A Shugart SA-400 mini-floppy disk drive. Soft sectored with a capacity of about 90 KB. IBM compatible format. Controller will handle 3 drives . . . **CPU** — 8080 based with a flexible design that allows you to implement a start up "jump to" operation to any dip switch selected byte address you choose. Merely turn on power or press RESET and you are off and running. Excellent for power failure automatic restart . . . **Memory** — 16K of static RAM memory. Low power chips. Selectable address assignment and memory protect features . . . **I/O** — 3P+3S input/output board. 3 parallel ports and 3 serial ports with selectable baud rates of 75 to 19,200. RS-232C and TTL outputs . . . **Video** — A video board provides the support for the video display functions . . . **Mainframe** — A 12 slot mainframe with a 17-amp CVT power supply, motherboard assembly, heavy duty aluminum cabinet, fan and washable filter. All edge connectors and card guides provided . . . **Software** — CP/M disk operating system and BASIC provided on disk.

the **Processor Terminal** (Model MCS-PT) fully assembled and tested is priced at $3495.00.

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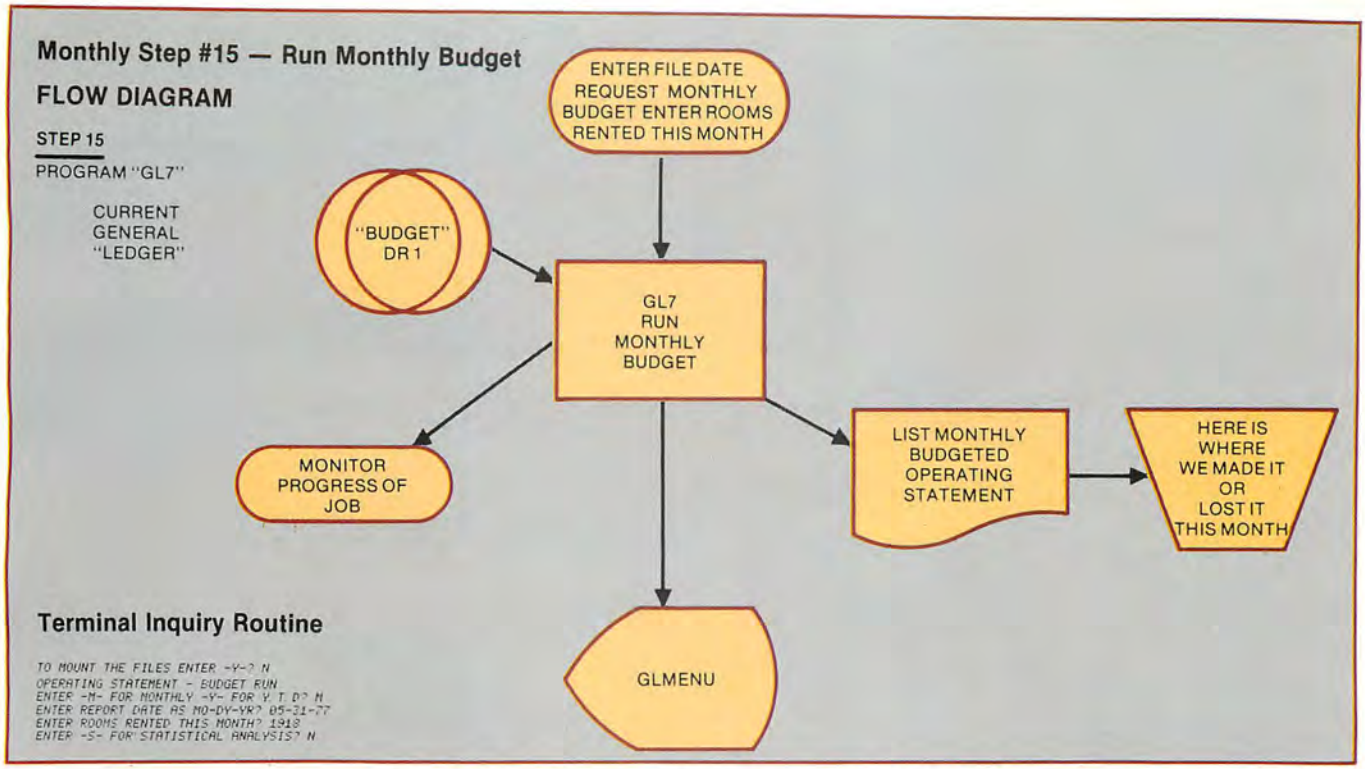
CIRCLE INQUIRY NO. 45

OPERATING STATEMENT - UNAUDITED - PERIOD ENDING 05-31-77

DATE MO DY YR	ACCT CNUMB VNUMB	DESCRIPTION	MONTHLY DEBITS	MONTHLY CREDITS	Y. T. D. BALANCE
		EXPENSES			
		COST OF ROOM SALES			
06-01-77	7100	GEN MGR BONUS			29,115.95
06-01-77	7101	NIGHT AUDITORS-PAYRL			19,977.15
06-01-77	7102	HOUSEKEEPER-PAYROLL			2,650.00
06-01-77	7103	LINEN PERSONS			2,243.17
06-01-77	7104	MAIDS-PAYROLL			21,213.12
06-01-77	7105	LAUNDRY-PAYROLL			4,901.70
06-01-77	7106	LINEN EXPENSE			5,363.75
06-01-77	7107	GUEST SUPPLIES			4,401.73
06-01-77	7108	CLEANING SUPPLIES			1,481.81
06-01-77	7109	LAUNDRY SUPPLIES			1,133.66
06-01-77	7110	MISC EXPENSE			569.52
06-01-77	7111	PEST CONTROLL			300.00
06-01-77	7112	TRAVEL AGENCY COMM			141.60
06-01-77	7113	UNIFORMS			136.56
06-01-77	7114	GEN MGR PAYROLL			1,092.75
06-01-77	7115	BELLMEN-PAYROLL			242.00
06-01-77	7116	SECURITY GUARD SERV			120.00
		TOT COST ROOM SALES	0.00	0.00	95,191.47
		COST OF TELEPHONE SERVICE			
06-01-77	7200	COST OF LONG DIST SR			11,470.83
06-01-77	7201	SWITCHBOARD RENT			7,379.18
06-01-77	7202	MISCELLANEOUS EXP			1,789.93
		TOT COST OF TEL SER	0.00	0.00	20,639.94
		COST OF OTHER SALES			
06-01-77	7300	GUEST LAUNDRY-VALET			1,254.54
06-01-77	7301	MAGAZ & SUNDRY EXP			1,653.25
06-01-77	7302	POP MACHINES EXP			3,514.32
06-01-77	7303	MISCELLANEOUS EXP			0.00
06-01-77	7304	COPY MACHINE EXP			813.76
		TOT COST OF OTH SALE	0.00	0.00	9,235.87
		GENERAL & ADMINISTRATIVE EXP			
06-01-77	7400	CREDIT CARD DISC			5,324.46
06-01-77	7402	DUES & SUBSCRIPTION			425.00
06-01-77	7403	LAND LEASE			9,600.00
06-01-77	7404	MISCELLANEOUS			270.14
06-01-77	7405	OFFICE SUPPLIES			2,152.32
06-01-77	7406	POSTAGE			332.15
06-01-77	7407	PROFESSIONAL SERV			10,285.09
06-01-77	7408	INTEREST EXPENSE			100,856.41
06-01-77	7409	ROYALTY PAYMENTS			8,368.12
06-01-77	7410	TELEPHONE & TELE			570.18
06-01-77	7411	TRAVEL-MOVING EXP			3,959.83
06-01-77	7412	PAYROLL TAXES			6,088.05
06-01-77	7413	BAD DEBTS			184.62
06-01-77	7414	FREIGHT & STORAGE			379.03
06-01-77	7415	CASH OVER & SHORT			144.13
06-01-77	7416	NCR MAINTANENCE AGRE			148.06
06-01-77	7417	RINA-TRAINING FEES			93.60
06-01-77	7418	COMPUTER SERVICES-JS			3,150.00
		TOT GEN & ADM EXP	0.00	0.00	152,331.19
		ADVERTISING & PROMOTION			
06-01-77	7500	MISCELLANEOUS			1,054.82
06-01-77	7501	NATIONAL ADV FUND			3,818.10
06-01-77	7502	NEWSPAPERS & MAGAZIN			183.00
06-01-77	7503	BILLBOARDS			3,337.06
06-01-77	7504	ON PREMISES SIGNS			6,429.68
		TOT ADV & PROMOTION	0.00	0.00	14,822.66
		REPAIRS & MAINTENANCE			
06-01-77	7600	CONTRACT LABOR-OTHER			2,344.84
06-01-77	7601	CONTRACT LABOR-ROB			703.15
06-01-77	7602	PAYROLL-FAM-JIM			1,850.28
06-01-77	7603	AIR COND & HEATING			738.22
06-01-77	7604	BUILDINGS			3,142.04
06-01-77	7605	CONTRACT SERVICES			500.00
06-01-77	7606	ELECTRICAL & MECHAN			2,550.08
06-01-77	7607	FURNISHINGS			611.02
06-01-77	7608	LAUNDRY			635.78
06-01-77	7609	MISCELLANEOUS			269.43
06-01-77	7610	PAINTING & DECORATNG			82.94
06-01-77	7611	PLUMBING			1,684.99
06-01-77	7612	POOL			3,309.29
06-01-77	7613	T.V. LEASE			1,761.00
06-01-77	7614	T.V. NON-LEASE			958.11
06-01-77	7615	PAYROLL-OUTSIDE			730.79
06-01-77	7616	GROUNDS MAINTANENCE			1,001.43
		TOT REPAIRS & MAINT	0.00	0.00	22,939.30
		UTILITIES			
06-01-77	7700	ELECTRICITY			11,775.39
06-01-77	7701	NATURAL GAS			11,484.97
06-01-77	7702	SEWER & GARBAGE			600.68
06-01-77	7703	WATER			1,234.42
		TOTAL UTILITIES	0.00	0.00	25,095.46
		RESERVATION EXP			
06-01-77	7800	RESERVATION FEES			3,071.48
06-01-77	7801	RAMADA TERMINAL			2,604.01
		TOT RESERVATION EXP	0.00	0.00	5,675.49
		INSURANCE, TAXES & DEPRECIATION			
06-01-77	7900	WORKMENS COMP INS			2,744.00
06-01-77	7901	GENERAL INS EXP			3,922.00
06-01-77	7902	PROPERTY TAXES			10,228.82
06-01-77	7903	DEPRECIATION EXP			69,851.04
06-01-77	7904	MORTGAGE INS			289.92
		TOT INS TAX & DEPR	0.00	0.00	86,635.78
		TOTAL EXPENSES	0.00	0.00	432,567.16
		PROFIT(-) OR LOSS(+)	0.00	0.00	37,903.76



Sample of Monthly Budget run as produced in Step 15 Program GL7

ACCT NUMB	DESCRIPTION	MONTHLY BUDGET	MONTHLY REPORT	MONTHLY OVER/UNDER	MONTHLY O/U%
	INCOME				
	ROOM-TEL-MEETING ROOM SALES				
4100	ROOM SALES	27,100.00-	32,432.50-	5,332.50-	19.68
4101	MEETING ROOM SALES	200.00-	140.00-	60.00	30.00-
4102	TELEPHONE SALES LONG	990.00-	1,812.82-	822.82-	83.21
	TOT ROOM-TELE-MEETING RM	28,290.00-	34,796.32-	6,096.32-	21.55
	MISCELLANEOUS SALES				
4200	TELEPHONE PAY STATON	14.00-	19.17-	5.17-	36.93
4201	RESTAURANT RENTAL	1,200.00-	1,200.00-	0.00	0.00
4202	SERVICE STATION RENT	500.00-	500.00-	0.00	0.00
4204	SALES TAX	26.00-	281.63-	255.63-	983.19
4205	BOWEN REST CR DISC	60.00-	108.97-	48.97-	81.62
4206	INTEREST INCOME	0.00	0.00	0.00	0.00
4207	MISC INCOME	0.01	0.00	0.01-	100.00-
	TOTAL MISCELLANEOUS SALES	1,899.99-	2,209.77-	309.78-	16.30
	SALES-OTHER				
4300	GAME MACHINE	100.00-	37.25-	62.75	62.75-
4301	GUEST LAUNDRY-VALET	100.00-	199.98-	99.98	99.98
4302	MAGAZINES & SUNDRIES	215.00-	515.69-	300.69-	139.86
4303	CIGARETTE MACHINES	12.00-	21.60-	9.60-	80.00
4304	POP MACHINES	345.00-	268.90-	76.10	22.06-
4305	COPY MACHINE	50.00-	0.00	50.00	100.00-
4306	CANDY-CONV MACHINES	25.00-	20.68-	4.32	17.28-
	TOTAL SALES-OTHER	947.00-	1,064.10-	217.10-	25.62
	TOTAL INCOME	31,036.99-	37,660.19-	6,622.20-	21.34

ACCT NUMB	DESCRIPTION	MONTHLY BUDGET	MONTHLY REPORT	MONTHLY OVER/UNDER	MONTHLY O/U%
	EXPENSES				
	COST OF ROOM SALES				
7100	GEN MGR BONUS	1,500.00	4,125.00	2,625.00	175.00
7101	NIGHT AUDITORS-PAYRL	1,500.00	1,358.91	141.19-	9.41-
7102	HOUSEKEEPER-PAYROLL	230.00	212.00	18.00-	7.82-
7103	LINEN PERSONS	230.00	205.37	24.63-	10.71-
7104	MAIDS-PAYROLL	1,650.00	1,423.66	226.34-	13.72-
7105	LAUNDRY-PAYROLL	400.00	586.17	186.17	46.54
7106	LINEN EXPENSE	193.00	1,094.89	899.89	461.48
7107	GUEST SUPPLIES	470.00	351.78	118.22-	25.15-
7108	CLEANING SUPPLIES	90.00	191.27	101.27	112.52
7109	LAUNDRY SUPPLIES	200.00	0.00	200.00-	100.00-
7110	MISC EXPENSE	24.00	17.00	7.00-	29.17-
7111	PEST CONTROLL	27.50	25.00	2.50-	9.09-
7112	TRAVEL AGENCY COMM	20.00	46.90	26.90	134.00
7113	UNIFORMS	17.00	0.00	17.00-	100.00-
7114	GEN MGR PAYROLL	0.00	0.00	0.00	0.00
7115	BELLMEN-PAYROLL	0.00	0.00	0.00	0.00
7116	SECURITY GUARD SERV	0.00	170.00	170.00	0.00
	TOTAL COST OF ROOM SALES	6,553.50	9,767.75	3,214.25	49.05
	COST OF TELEPHONE SERVICE				
7200	COST OF LONG DIST SR	790.00	924.19	134.19	16.99
7201	SWITCHBOARD RENT	552.00	629.06	77.06	13.96
7202	MISCELLANEOUS EXP	33.00	158.95	125.95	381.67
	TOT COST OF TELEPHONE SER	1,375.00	1,712.20	337.20	24.52
	COST OF OTHER SALES				
7300	GUEST LAUNDRY-VALET	105.00	258.25	153.25	145.95
7301	MAGAZ & SUNDRY EXP	215.00	259.59	44.59	20.74
7302	POP MACHINES EXP	293.00	125.77	32.77	11.18
7303	MISCELLANEOUS EXP	5.50	0.00	5.50-	100.00-
7304	COPY MACHINE EXP	50.00	42.00	8.00-	16.00-
	TOTAL COST OF OTHER SALES	668.50	885.61	217.11	32.48
	GENERAL & ADMINISTRATIVE EXPENSE				
7400	CREDIT CARD DISC	413.50	440.51	27.01	6.54
7402	DUES & SUBSCRIPTION	26.50	0.00	26.50-	100.00-
7407	LAND LEHSE	800.00	800.00	0.00	0.00
7404	MISCELLANEOUS	19.00	0.00	19.00-	100.00-
7405	OFFICE SUPPLIES	167.00	0.00	167.00-	100.00-
7406	POSTAGE	18.00	0.00	18.00-	100.00-
7407	PROFESSIONAL SERV	100.00	0.00	100.00-	100.00-
7408	INTEREST EXPENSE	9,181.10	9,096.94	84.16-	0.92-
7409	ROYALTY PAYMENTS	815.00	587.55	227.45-	27.91-
7410	TELEPHONE & TELE	27.00	46.02	19.02	70.48
7411	TRAVEL-MOVING EXP	200.00	732.87	532.87	266.44
7412	PAYROLL TAXES	665.00	0.00	665.00-	100.00-
7413	BAD DEBTS	0.00	0.00	0.00	0.00
7414	FREIGHT & STORAGE	0.00	5.08	5.08	0.00
7415	CASH OVER & SHORT	0.00	0.00	0.00	0.00
7416	NCR MAINTANENCE AGRE	0.00	0.00	0.00	0.00
7417	RMA-TRAINING FEES	0.00	27.40	27.40	0.00
7418	COMPUTER SERVICES-IS	0.00	350.00	350.00	0.00
	TOT GENERAL & ADM EXPENSE	12,432.10	12,082.40	349.70-	2.81-
	ADVERTISING & PROMOTION				
7500	MISCELLANEOUS	10.00	0.00	10.00-	100.00-
7501	NATIONAL ADV FUND	290.00	108.10	18.10	6.24
7502	NEWSPAPERS & MAGAZIN	5.00	17.50	12.50	250.00
7503	BILLBOARDS	500.00	266.44	233.56-	46.71-
7504	ON PREMISES SIGNS	537.05	546.42	9.37	1.74
	TOT ADVERTISING-PROMOTION	1,342.05	1,139.46	203.59-	15.17-
	REPAIRS & MAINTENANCE				
7600	CONTRACT LABOR-OTHER	250.00	207.58	42.42-	16.97-
7601	CONTRACT LABOR-ROE	100.00	94.15	5.85-	5.85-
7602	PAYROLL-R&M-JIM	200.00	147.78	52.22-	26.11-
7603	AIR COND & HEATING	115.00	129.44	14.44	12.56
7604	BUILDINGS	25.00	0.00	25.00-	100.00-
7605	CONTRACT SERVICES	25.00	0.00	25.00-	100.00-
7606	ELECTRICAL & MECHAN	100.00	197.47	97.47	97.47
7607	FURNISHINGS	10.00	41.15	31.15	311.50
7608	LAUNDRY	90.00	0.00	90.00-	100.00-
7609	MISCELLANEOUS	50.00	0.00	50.00-	100.00-
7610	PAINTING & DECORATNG	25.00	0.00	25.00-	100.00-
7611	PLUMBING	15.00	1,463.92	1,448.92	9,659.52
7612	POOL	80.00	672.02	592.02	740.04
7613	T V LEASE	146.75	146.75	0.00	0.00
7614	T V NON-LEASE	80.00	52.38	27.62-	34.53-
7615	PAYROLL-OUTSIDE	0.00	0.00	0.00	0.00
7616	GROUNDS MAINTANENCE	0.00	767.30	767.30	0.00
	TOTAL REPAIRS & MAINTENANCE	1,321.75	2,920.46	2,598.71	196.61
	UTILITIES				
7700	ELECTRICITY	585.00	1,024.76	449.76	76.88
7701	NATURAL GAS	570.00	1,212.80	642.80	112.95
7702	SEWER & GARBAGE	56.00	152.68	96.68	172.64
7703	WATER	240.00	97.75	142.25-	59.27-
	TOTAL UTILITIES	1,451.00	2,498.99	1,047.99	72.21
	RESERVATION EXPENSE				
7800	RESERVATION FEES	210.00	0.00	210.00-	100.00-
7801	RAMADA TERMINAL	214.50	183.79	30.71-	14.32-
	TOTAL RESERVATION EXPENSE	424.50	183.79	240.71-	56.70-
	INSURANCE-TAXES-DEPRECIATION				
7900	WORKMENS COMP INS	125.00	0.00	125.00-	100.00-
7901	GENERAL INS EXP	125.00	0.00	125.00-	100.00-
7902	PROPERTY TAXES	1,675.00	4,842.82	3,167.82	250.49
7903	DEPRECIATION EXP	5,820.92	5,820.92	0.00	0.00
7904	MORTGAGE INS	0.00	0.00	0.00	0.00
	TOT INS-TAXES-DEPREC	7,745.92	10,663.74	3,317.82	45.17
	TOTAL EXPENSES	32,914.32	42,853.40	9,939.08	30.20
	NET PROFIT(+) OR LOSS(-)	1,877.33	5,193.21	3,315.88	176.67
	CASH FLOW	2,412.94-	987.10	3,400.04	140.91-
	NUMBER ROOMS RENTED	1,898.00	1,918.00	20.00	1.05
	AVERAGE ROOM RATE	14.28	16.31	2.03	13.41
	OCCUPANCY RATE	80.00	80.84	0.84	1.05

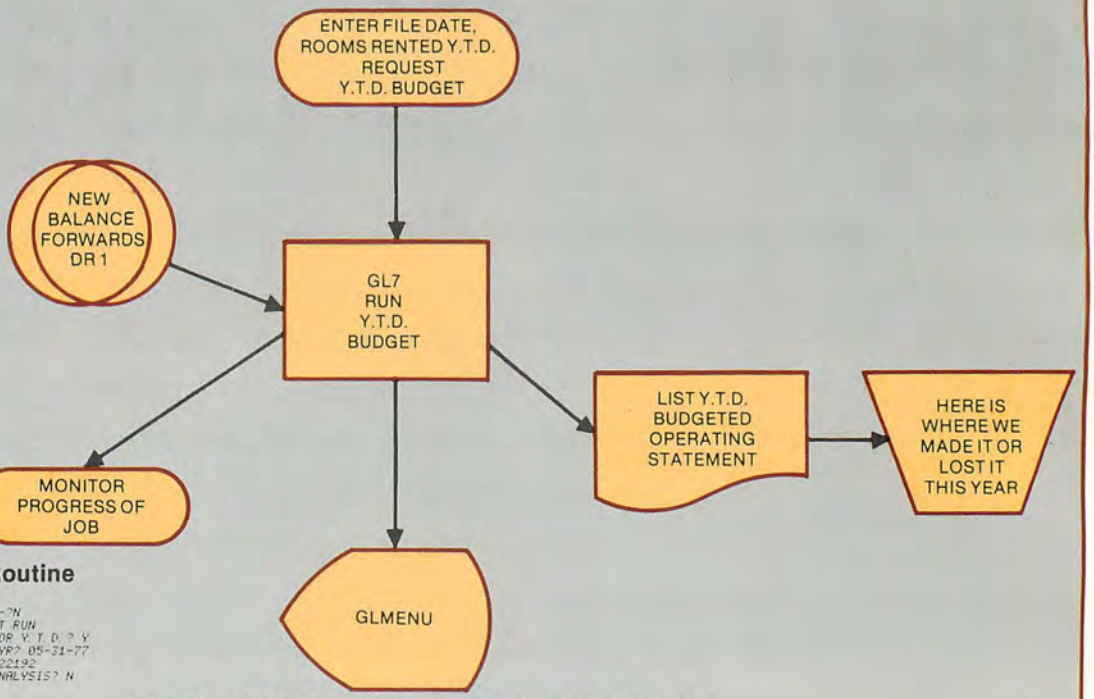
Monthly Step #16 — Run Y.T.D. Budget

FLOW DIAGRAM

STEP 16

PROGRAM "GL7"

CURRENT GENERAL "LEDGER"



Terminal Inquiry Routine

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TO MOUNT THE FILES ENTER -Y-?N
OPERATING STHTEMENT - BUDGET RUN
ENTER -M- FOR MONTHLY -Y- FOR Y.T.D.? Y
ENTER REPORT DATE AS MO-DY-YR? 05-31-77
ENTER ROOMS RENTED Y.T.D.? 22192
ENTER -S- FOR STATISTICAL ANALYSIS? N
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Sample of Y.T.D. Budget run produced in Step 16 Program GL7

ACCT NUMB	DESCRIPTION	Y.T.D. BUDGET	Y.T.D. REPORT	Y.T.D. OVER/UNDER	Y.T.D. O/U%
	INCOME				
	ROOM-TEL-MEETING ROOM SALES				
4100	ROOM SALES	325,200.00-	340,061.89-	14,861.89-	4.57
4101	MEETING ROOM SALES	2,400.00-	2,919.45-	519.45-	21.64
4102	TELEPHONE SALES LONG	11,880.00-	16,331.27-	4,451.27-	37.47
	TOT ROOM-TELE-MEETING RM	339,480.00-	359,312.61-	19,832.61-	5.84
	MISCELLANEOUS SALES				
4200	TELEPHONE PAY STATON	168.00-	148.57-	19.43	11.57-
4201	RESTAURANT RENTAL	15,600.00-	15,600.00-	0.00	0.00
4203	SERVICE STATION RENT	6,000.00-	6,000.00-	0.00	0.00
4204	SALES TAX	312.00-	233.09-	78.91	25.29-
4205	BOWEN REST CR DISC	720.00-	1,392.94-	672.94-	93.46
4206	INTEREST INCOME	0.00	319.11-	319.11-	0.00
4207	MISC INCOME	0.11	236.68-	236.79-	219,248.15-
	TOTAL MISCELLANEOUS SALES	22,799.89-	23,930.39-	1,130.50-	4.96
	SALES-OTHER				
4300	GAME MACHINE	1,200.00-	689.61-	510.39	42.53-
4301	GUEST LAUNDRY-VALET	1,200.00-	1,309.85-	109.85-	9.15
4302	MAGAZINES & SUNDRIES	2,580.00-	5,119.44-	2,539.44-	98.43
4303	CIGARETTE MACHINES	144.00-	250.92-	106.92-	74.25
4304	POP MACHINES	4,140.00-	3,609.41-	530.59	12.82-
4305	COPY MACHINE	600.00-	124.50-	475.50	79.25-
4306	CANDY-CONV MACHINES	100.00-	116.67-	16.67-	5.56
	TOTAL SALES-OTHER	10,164.00-	11,420.40-	1,256.40-	12.36
	TOTAL INCOME	372,443.89-	394,663.40-	22,219.51-	5.97

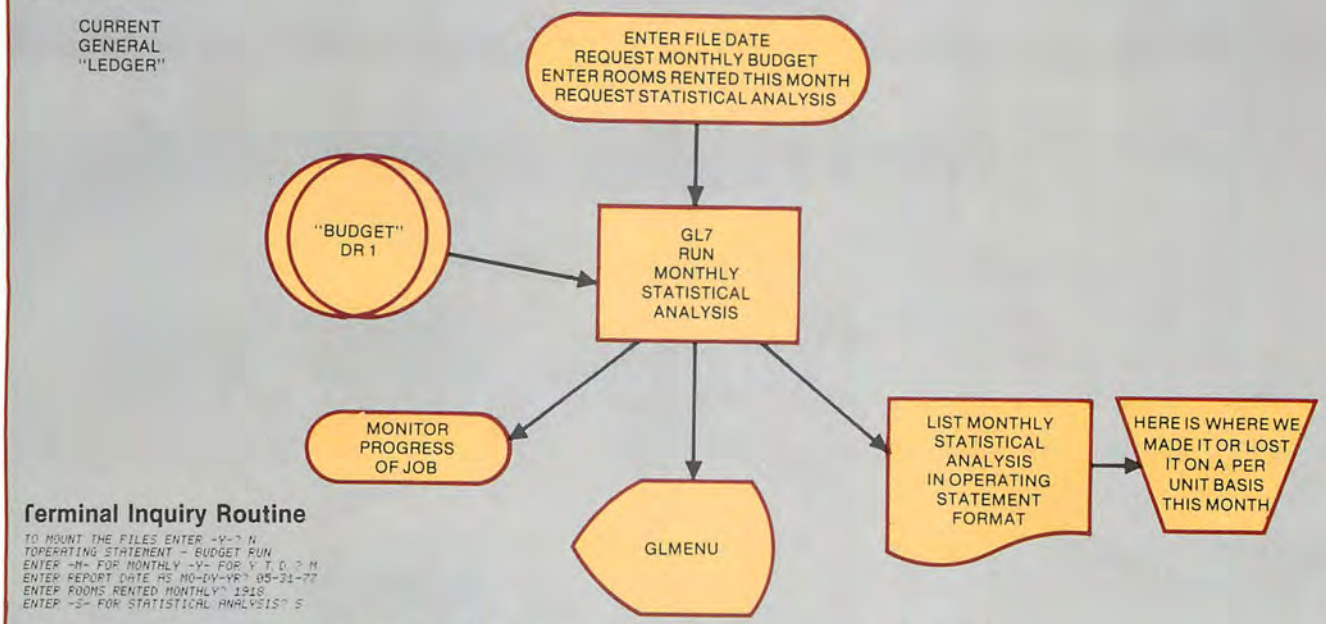
ACCT NUMB	DESCRIPTION	Y.T.D. BUDGET	Y.T.D. REPORT	Y.T.D. OVER/UNDER	Y.T.D. O/U%
	EXPENSES				
	COST OF ROOM SALES				
7100	GEN MGR BONUS	18,000.00	29,115.95	11,115.95	61.76
7101	NIGHT AUDITORS-PAYRL	18,000.00	19,972.15	1,972.15	10.96
7102	HOUSEKEEPER-PAYROLL	2,760.00	2,650.00	110.00-	3.99-
7103	LINEN PERSONS	2,760.00	2,343.17	416.83-	15.10-
7104	MAIDS-PAYROLL	19,800.00	21,217.12	1,417.12	7.14
7105	LAUNDRY-PAYROLL	4,800.00	4,901.79	101.79	2.12
7106	LINEN EXPENSE	2,340.00	5,363.75	3,023.75	129.22
7107	GUEST SUPPLIES	5,640.00	4,401.73	1,238.27-	21.96-
7108	CLEANING SUPPLIES	1,080.00	1,481.81	401.81	37.20
7109	LAUNDRY SUPPLIES	2,400.00	1,133.66	1,266.34-	52.76-
7110	MISC EXPENSE	288.00	569.52	281.52	97.75
7111	PEST CONTROLL	330.00	300.00	30.00-	9.09-
7112	TRAVEL AGENCY COMM	240.00	141.60	98.40-	41.00-
7113	UNIFORMS	204.00	126.56	67.44-	33.06-
7114	GEN MGR PAYROLL	0.00	1,092.75	1,092.75	0.00
7115	BELLMEN-PAYROLL	0.00	242.00	242.00	0.00
7116	SECURITY GUARD SERV	0.00	120.00	120.00	0.00
	TOTAL COST OF ROOM SALES	78,642.00	95,191.47	16,549.47	21.04
	COST OF TELEPHONE SERVICE				
7200	COST OF LONG DIST SR	9,480.00	11,470.93	1,990.93	21.00
7201	SWITCHBOARD RENT	6,624.00	7,379.18	755.18	11.40
7202	MISCELLANEOUS EXP	396.00	1,789.93	1,393.93	352.00
	TOT COST OF TELEPHONE SER	16,500.00	20,639.94	4,139.94	25.09
	COST OF OTHER SALES				
7300	GUEST LAUNDRY-VALET	1,260.00	1,254.54	5.46-	0.43-
7301	MAGAZ & SUNDRY EXP	2,580.00	3,653.25	1,073.25	41.60
7302	POP MACHINES EXP	1,516.00	1,514.32	1.68-	0.05-
7303	MISCELLANEOUS EXP	66.00	0.00	66.00-	100.00-
7304	COPY MACHINE EXP	600.00	813.76	213.76	35.61
	TOTAL COST OF OTHER SALES	6,022.00	9,235.87	1,213.87	15.13
	GENERAL & ADMINISTRATIVE EXPENSE				
7400	CREDIT CARD DISC	4,962.00	5,324.46	362.46	7.30
7402	DUES & SUBSCRIPTION	318.00	425.00	107.00	33.65
7403	LAND LEASE	9,600.00	9,600.00	0.00	0.00
7404	MISCELLANEOUS	228.00	270.14	42.14	18.48
7405	OFFICE SUPPLIES	2,004.00	2,152.32	148.32	7.40
7406	POSTAGE	216.00	332.15	116.15	53.77
7407	PROFESSIONAL SERV	1,200.00	10,285.09	9,085.09	757.09
7408	INTEREST EXPENSE	110,173.20	100,856.41	9,316.79-	8.46-
7409	ROYALTY PAYMENTS	9,780.00	8,368.12	1,411.88-	14.44-
7410	TELEPHONE & TELE	324.00	570.18	246.18	75.98
7411	TRAVEL-MOVING EXP	2,400.00	3,959.82	1,559.82	64.99
7412	PAYROLL TAXES	7,980.00	6,088.05	1,891.95-	23.71-
7413	BAD DEBTS	0.00	184.62	184.62	0.00
7414	FREIGHT & STORAGE	0.00	379.03	379.03	0.00
7415	CASH OVER & SHORT	0.00	144.13	144.13	0.00
7416	NCR MAINTANENCE HGRE	0.00	148.06	148.06	0.00
7417	RINA-TRAINING FEES	0.00	93.60	93.60	0.00
7418	COMPUTER SERVICES-IS	0.00	3,150.00	3,150.00	0.00
	TOT GENERAL & ADM EXPENSE	149,185.20	152,331.19	3,145.99	2.11
	ADVERTISING & PROMOTION				
7500	MISCELLANEOUS	120.00	1,054.82	934.82	779.02
7501	NATIONAL ADV FUND	7,480.00	7,818.10	338.10	9.72
7502	NEWSPAPERS & MAGAZIN	60.00	183.00	123.00	205.00
7503	BILLBOARDS	6,000.00	3,337.06	2,662.94-	44.38-
7504	ON PREMISES SIGNS	5,444.60	6,429.68	14.92-	0.27-
	TOT ADVERTISING-PROMOTION	16,104.60	14,822.66	1,281.94-	7.96-
	REPAIRS & MAINTENANCE				
7600	CONTRACT LABOR-OTHER	7,000.00	2,744.64	655.16-	21.84-
7601	CONTRACT LABOR-POE	1,200.00	709.15	490.85-	40.90-
7602	PAYROLL-R&M-TIM	2,400.00	1,850.28	549.72-	22.90-
7603	AIR COND & HEATING	1,180.00	798.22	381.78-	32.16-
7604	BUILDINGS	200.00	2,142.04	2,842.04	947.35
7605	CONTRACT SERVICES	420.00	500.00	80.00	19.05
7606	ELECTRICAL & MECHAN	1,200.00	2,550.08	1,750.08	112.51
7607	FURNISHINGS	120.00	611.02	491.02	409.18
7608	LAUNDRY	1,080.00	635.78	444.22-	41.11-
7609	MISCELLANEOUS	500.00	269.43	230.57-	55.10-
7610	PAINTING & DECORATNG	100.00	32.94	217.06-	76.75-
7611	PLUMBING	180.00	1,684.99	1,504.99	835.11
7612	POOL	960.00	1,209.23	249.23	244.72
7613	T V LEASE	1,761.00	1,761.00	0.00	0.00
7614	T V NON-LEASE	960.00	958.11	1.89-	0.20-
7615	PAYROLL-OUTSIDE	0.00	720.70	720.70	0.00
7616	GROUNDS MAINTANENCE	0.00	1,001.42	1,001.42	0.00
	TOTAL REPAIRS & MAINTENANCE	15,861.00	22,939.30	7,078.30	44.62
	UTILITIES				
7700	ELECTRICITY	7,020.00	11,775.29	4,755.29	67.74
7701	NATURAL GAS	6,840.00	11,484.97	4,644.97	67.91
7702	SEWER & GARBAGE	672.00	600.68	71.32-	10.61-
7703	WATER	2,880.00	1,234.42	1,645.58-	57.14-
	TOTAL UTILITIES	17,412.00	25,095.46	7,683.46	44.12
	RESERVATION EXPENSE				
7800	RESERVATION FEES	2,520.00	3,071.48	551.48	21.88
7801	RAMADA TERMINAL	2,574.00	2,604.01	30.01	1.17
	TOTAL RESERVATION EXPENSE	5,094.00	5,675.49	581.49	11.42
	INSURANCE-TAXES-DEPRECIATION				
7900	WORKMENS COMP INS	1,500.00	2,344.00	844.00	56.27
7901	GENERAL INS EXP	2,900.00	2,922.00	22.00	0.76
7902	PROPERTY TAXES	12,900.00	10,228.82	2,671.18-	20.71-
7903	DEPRECIATION EXP	69,851.04	69,851.04	0.00	0.00
7904	MORTGAGE INS	0.00	289.92	289.92	0.00
	TOT INS-TAXES-DEPREC	88,151.04	86,635.78	1,515.26-	1.72-
	TOTAL EXPENSES	394,371.84	422,567.16	28,195.32	9.52
	NET PROFIT(-) OR LOSS(+)	22,527.95	27,903.76	15,375.81	68.25
	CASH FLOW	28,355.29-	4,262.69-	24,692.60	85.28-
	NUMBER ROOMS RENTED	22,776.00	22,192.00	584.00-	2.56-
	AVERAGE ROOM RATE	14.28	15.12	1.04	7.31
	OCCUPANCY RATE	80.00	77.95	2.05-	2.56-

Monthly Step #17 — Run Monthly Statistical Report

FLOW DIAGRAM

STEP 17

PROGRAM "GL7"



Terminal Inquiry Routine

```
TO MOUNT THE FILES ENTER -Y-? N
TOPERATING STHTEMENT - BUDGET RUN
ENTER -M- FOR MONTHLY -Y- FOR Y.T.D.? M
ENTER REPORT DATE AS MO-DY-YR? 05-31-77
ENTER ROOMS RENTED MONTHLY? 1918
ENTER -S- FOR STATISTICAL ANALYSIS? S
```

Sample of Monthly Statistical Report run as produced in Step 17 Program GL7

```
BUDGETED AVERAGE 1,885.00 ACTUAL      1,918.00   ACTUAL AVERAGE  2,272.50
OCCUPIED ROOMS = 80.00%   OCCUPIED ROOMS = 80.04%  AVAILABLE ROOMS = 100.00%

ACCT                          BUDGET      ACTUAL      ACTUAL
NUMB    DESCRIPTION         PER OCCUP   PER OCCUP   PER AVAIL

        INCOME

ROOM-TEL-MEETING ROOM SALES
4100 ROOM SALES              14.28-      16.91-      13.58-
4101 MEETING ROOM SALES       0.11-       0.07-       0.06-
4102 TELEPHONE SALES LONG     0.52-       0.95-       0.76-

TOT ROOM-TELE-MEETING RM     14.91-      17.93-      14.40-

MISCELLANEOUS SALES
4200 TELEPHONE PAY STATON     0.01-       0.01-       0.01-
4201 RESTAURANT RENTAL        0.58-       0.58-       0.55-
4202 SERVICE STATION RENT     0.26-       0.26-       0.21-
4204 SALES TAX                0.01-       0.15-       0.12-
4205 BOWEN REST CR DISC       0.02-       0.06-       0.05-
4206 INTEREST INCOME          0.00        0.00        0.00
4207 MISC INCOME              0.00        0.00        0.00

TOTAL MISCELLANEOUS SALES     1.00-       1.15-       0.92-

SALES-OTHER
4300 GAME MACHINE             0.05-       0.02-       0.02-
4301 GUEST LAUNDRY-VALET      0.05-       0.10-       0.08-
4302 MAGAZINES & SUNDRIES     0.11-       0.27-       0.22-
4303 CIGARETTE MACHINES       0.01-       0.01-       0.01-
4304 POP MACHINES             0.18-       0.14-       0.11-
4305 COPY MACHINE             0.02-       0.00        0.00
4306 CANDY-CONV MACHINES      0.01-       0.01-       0.01-

TOTAL SALES-OTHER             0.45-       0.55-       0.45-


TOTAL INCOME                 16.35-      19.64-      15.87-

ACCT                          BUDGET      ACTUAL      ACTUAL
NUMB    DESCRIPTION         PER OCCUP   PER OCCUP   PER AVAIL

        EXPENSES

COST OF ROOM SALES
7100 GEN MGR BONUS            0.79        2.15        1.74
7101 NIGHT AUDITORS-PAYRL     0.79        0.71        0.57
7102 HOUSEKEEPER-PAYROLL      0.12        0.11        0.09
7103 LINEN PERSONS            0.12        0.11        0.09
7104 MAIDS-PAYROLL            0.87        0.74        0.60
7105 LAUNDRY-PAYROLL          0.21        0.31        0.25
7106 LINEN EXPENSE            0.10        0.57        0.46
7107 GUEST SUPPLIES           0.25        0.19        0.15
7108 CLEANING SUPPLIES        0.05        0.10        0.08
7109 LAUNDRY SUPPLIES         0.11        0.00        0.00
7110 MISC EXPENSE             0.01        0.01        0.01
7111 PEST CONTROLL            0.01        0.01        0.01
7112 TRAVEL AGENCY COMM       0.01        0.02        0.02
7113 UNIFORMS                 0.01        0.00        0.00
7114 GEN MGR PAYROLL          0.00        0.00        0.00
7115 BELLMEN-PAYROLL          0.00        0.00        0.00
7116 SECURITY GUARD SERV      0.00        0.07        0.05

TOTAL COST OF ROOM SALES      3.45        5.09        4.12

COST OF TELEPHONE SERVICE
7200 COST OF LONG DIST SR     0.42        0.48        0.39
7201 SWITCHBOARD RENT         0.29        0.32        0.27
7202 MISCELLANEOUS EXP        0.02        0.08        0.07

TOT COST OF TELEPHONE SER     0.72        0.89        0.72

COST OF OTHER SALES
7300 GUEST LAUNDRY-VALET      0.06        0.13        0.11
7301 MAGAZ & SUNDRY EXP       0.11        0.14        0.11
7302 POP MACHINES EXP         0.15        0.17        0.14
7303 MISCELLANEOUS EXP        0.00        0.00        0.00
7304 COPY MACHINE EXP         0.02        0.02        0.02

TOTAL COST OF OTHER SALES     0.35        0.46        0.37

GENERAL & ADMINISTRATIVE EXPENSE
7400 CREDIT CARD DISC         0.22        0.27        0.19

7402 DUES & SUBSCRIPTION      0.01        0.02        0.01
7403 LAND LEASE               0.42        0.42        0.34
7404 MISCELLANEOUS            0.01        0.01        0.01
7405 OFFICE SUPPLIES          0.09        0.10        0.08
7406 POSTAGE                  0.01        0.01        0.01
7407 PROFESSIONAL SERV        0.05        0.46        0.36
7408 INTEREST EXPENSE         4.84        4.54        3.54
7409 ROYALTY PAYMENTS         0.41        0.38        0.29
7410 TELEPHONE & TELE         0.01        0.02        0.02
7411 TRAVEL-MOVING EXP        0.11        0.18        0.14
7412 PAYROLL TAXES            0.35        0.27        0.21
7413 BAD DEBTS                0.00        0.01        0.01
7414 FREIGHT & STORAGE        0.00        0.01        0.01
7415 CASH OVER & SHORT        0.00        0.01        0.01
7416 NCR MAINTANENCE AGRE     0.00        0.01        0.01
7417 RINA-TRAINING FEES       0.00        0.00        0.00
7418 COMPUTER SERVICES-IS     0.00        0.14        0.11

TOT GENERAL & ADM EXPENSE     6.55        6.86        5.35

ADVERTISING & PROMOTION
7500 MISCELLANEOUS            0.01        0.05        0.04
7501 NATIONAL ADV FUND        0.15        0.17        0.13
7502 NEWSPAPERS & MAGAZIN     0.00        0.01        0.01
7503 BILLBOARDS               0.26        0.15        0.12
7504 ON PREMISES SIGNS        0.29        0.29        0.22

TOT ADVERTISING-PROMOTION     0.71        0.67        0.52

REPAIRS & MAINTENANCE
7600 CONTRACT LABOR-OTHER     0.12        0.11        0.08
7601 CONTRACT LABOR-POOL      0.03        0.02        0.02
7602 PAYROLL-R&M-TIM          0.11        0.08        0.06
7603 AIR COND & HEATING       0.05        0.04        0.03
7604 BUILDINGS                0.01        0.14        0.11
7605 CONTRACT SERVICES        0.02        0.02        0.02
7606 ELECTRICAL & MECHAN      0.05        0.11        0.09
7607 FURNISHINGS              0.01        0.03        0.02
7608 LAUNDRY                  0.05        0.03        0.02
7609 MISCELLANEOUS            0.02        0.01        0.01
7610 PAINTING & DECORATNG     0.01        0.00        0.00
7611 PLUMBING                 0.01        0.08        0.06
7612 POOL                     0.04        0.15        0.12
7613 T.V LEASE                0.08        0.08        0.06
7614 T.V. NON-LEASE           0.04        0.04        0.03
7615 PAYROLL-OUTSIDE          0.00        0.03        0.02
7616 GROUNDS MAINTANENCE      0.00        0.05        0.04

TOTAL REPAIRS & MAINTENANCE   0.70        1.07        0.81

UTILITIES
7700 ELECTRICITY              0.71        0.57        0.41
7701 NATURAL GAS              0.70        0.52        0.40
7702 SEWER & GARBAGE          0.03        0.03        0.02
7703 WATER                    0.13        0.06        0.04

TOTAL UTILITIES               0.76        1.13        0.88

RESERVATION EXPENSE
7800 RESERVATION FEES         0.11        0.14        0.11
7801 RAMADA TERMINAL          0.11        0.12        0.09

TOTAL RESERVATION EXPENSE     0.22        0.26        0.20

INSURANCE-TAXES-DEPRECIATION
7900 WORKMENS COMP INS        0.07        0.11        0.08
7901 GENERAL INS EXP          0.17        0.19        0.14
7902 PROPERTY TAXES           0.57        0.46        0.36
7903 DEPRECIATION EXP         3.07        3.15        2.45
7904 MORTGAGE INS             0.00        0.01        0.01

TOT INS-TAXES-DEPREC          3.87        3.90        3.04

TOTAL EXPENSES               17.24       19.49       15.19

NET PROFIT(-) OR LOSS(+)      0.89        1.71        1.33

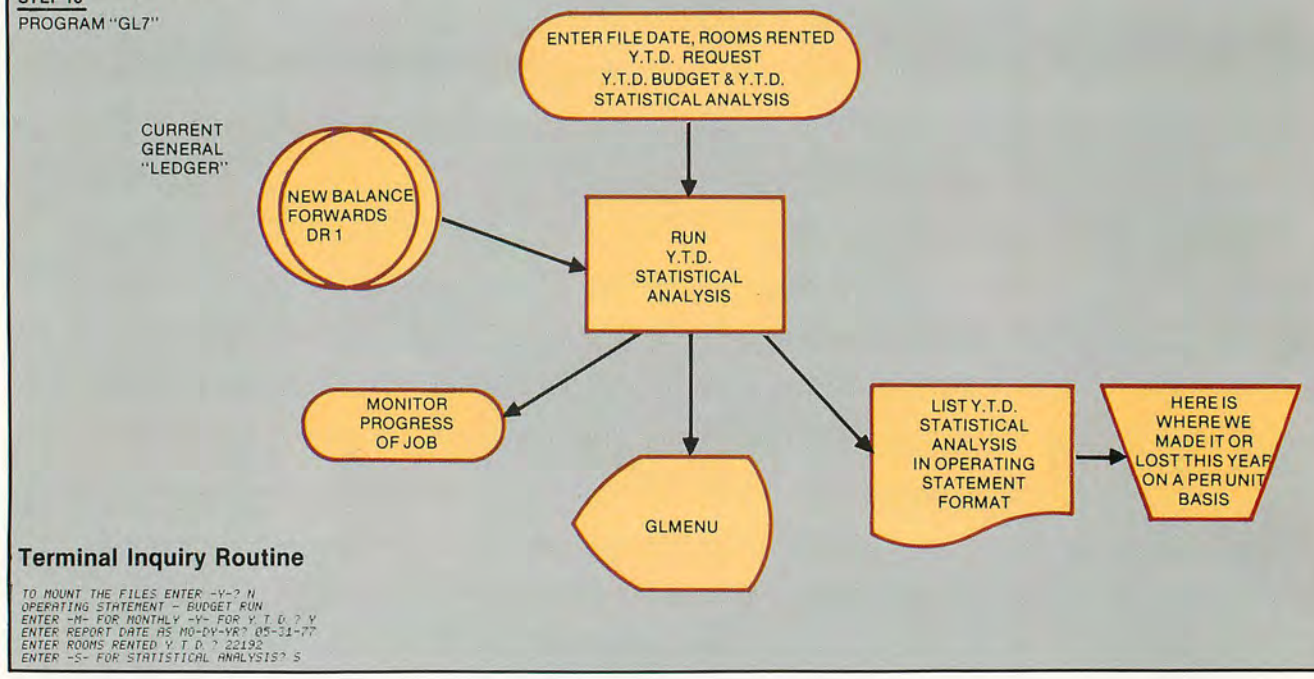
CASH FLOW                     1.27-       0.19-       0.15-
```

Monthly Step #18 — Run Y.T.D. Statistical Report

FLOW DIAGRAM

STEP 18

PROGRAM "GL7"



Terminal Inquiry Routine

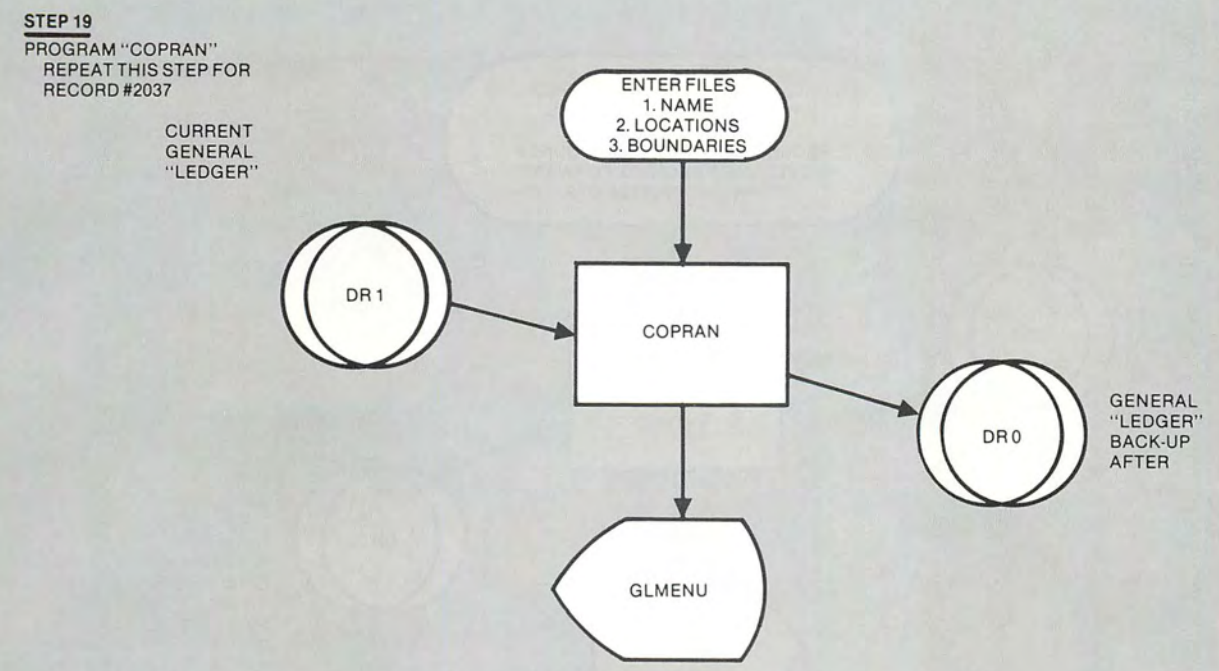
```
TO MOUNT THE FILES ENTER -Y-? N
OPERATING STATEMENT - BUDGET RUN
ENTER -M- FOR MONTHLY -Y- FOR Y.T.D.? Y
ENTER REPORT DATE AS MO-DY-YR? 05-31-77
ENTER ROOMS RENTED Y.T.D.? 22192
ENTER -S- FOR STATISTICAL ANALYSIS? S
```

Sample of Y.T.D. Statistical Report run as produced in Step 18 Program GL7

BUDGETED AVERAGE22,776.00 ACTUAL 22,192.00 ACTUAL AVERAGE 28,470.00
OCCUPIED ROOMS = 80.00% OCCUPIED ROOMS = 77.95% AVAILABLE ROOMS = 100.00%

ACCT NUMB	DESCRIPTION	BUDGET PER OCCUP	ACTUAL PER OCCUP	ACTUAL PER AVAIL
	INCOME			
	ROOM-TEL-MEETING ROOM SALES			
4100	ROOM SALES	14.28-	15.72-	11.94-
4101	MEETING ROOM SALES	0.11-	0.12-	0.10-
4102	TELEPHONE SALES LONG	0.52-	0.74-	0.57-
	TOT ROOM-TELE-MEETING RM	14.91-	16.19-	12.62-
	MISCELLANEOUS SALES			
4200	TELEPHONE PAY STATON	0.01-	0.01-	0.01-
4201	RESTAURANT RENTAL	0.68-	0.70-	0.55-
4203	SERVICE STATION RENT	0.26-	0.27-	0.21-
4204	SALES TAX	0.01-	0.01-	0.01-
4205	BOWEN REST CR DISC	0.07-	0.06-	0.05-
4206	INTEREST INCOME	0.00	0.01-	0.01-
4207	MISC INCOME	0.00	0.01-	0.01-
	TOTAL MISCELLANEOUS SALES	1.00-	1.08-	0.84-
	SALES-OTHER			
4300	GAME MACHINE	0.05-	0.03-	0.02-
4301	GUEST LNUNDRY-VALET	0.05-	0.06-	0.05-
4302	MAGAZINES & SUNDRIES	0.11-	0.23-	0.18-
4303	CIGARETTE MACHINES	0.01-	0.01-	0.01-
4304	POP MACHINES	0.18-	0.16-	0.13-
4305	COPY MACHINE	0.02-	0.01-	0.00-
4306	CANDY-CONV MACHINES	0.01-	0.01-	0.01-
	TOTAL SALES-OTHER	0.45-	0.51-	0.40-
	TOTAL INCOME	16.75-	17.78-	13.86-
	COST OF ROOM SALES			
7100	GEN MGR BONUS	0.79	1.31	1.02
7101	NIGHT AUDITORS-PAYRL	0.79	0.90	0.70
7102	HOUSEKEEPER-PAYROLL	0.12	0.12	0.09
7103	LINEN PERSONS	0.12	0.11	0.08
7104	MAIDS-PAYROLL	0.97	0.96	0.75
7105	LAUNDRY-PAYROLL	0.21	0.22	0.17
7106	LINEN EXPENSE	0.10	0.24	0.19
7107	GUEST SUPPLIES	0.25	0.20	0.15
7108	CLEANING SUPPLIES	0.05	0.07	0.05
7109	LAUNDRY SUPPLIES	0.11	0.05	0.04
7110	MISC EXPENSE	0.01	0.03	0.02
7111	PEST CONTROLL	0.01	0.01	0.01
7112	TRAVEL AGENCY COMM	0.01	0.01	0.00
7113	UNIFORMS	0.01	0.01	0.00
7114	GEN MGR PAYROLL	0.08	0.05	0.04
7115	BELLMEN-PAYROLL	0.00	0.01	0.01
7116	SECURITY GUARD SERV	0.00	0.01	0.00
	TOTAL COST OF ROOM SALES	3.45	4.29	3.34
	COST OF TELEPHONE SERVICE			
7200	COST OF LONG DIST SR	0.42	0.52	0.40
7201	SWITCHBOARD RENT	0.29	0.33	0.26
7202	MISCELLANEOUS EXP	0.02	0.08	0.06
	TOT COST OF TELEPHONE SER	0.72	0.93	0.72
	COST OF OTHER SALES			
7300	GUEST LNUNDRY-VALET	0.06	0.06	0.04
7301	MAGAZ & SUNDRY EXP	0.11	0.16	0.12
7302	POP MACHINES EXP	0.15	0.16	0.12
7303	MISCELLANEOUS EXP	0.00	0.00	0.00
7304	COPY MACHINE EXP	0.03	0.04	0.03
	TOTAL COST OF OTHER SALES	0.35	0.42	0.32
	GENERAL & ADMINISTRATIVE EXPENSE			
7400	CREDIT CARD DISC	0.22	0.24	0.19
7402	DUES & SUBSCRIPTION	0.01	0.00	0.00
7403	LAND LEASE	0.42	0.42	0.34
7404	MISCELLANEOUS	0.01	0.00	0.00
7405	OFFICE SUPPLIES	0.09	0.00	0.00
7406	POSTAGE	0.01	0.00	0.00
7407	PROFESSIONAL SERV	0.05	0.00	0.00
7408	INTEREST EXPENSE	4.84	4.74	3.84
7409	ROYALTY PAYMENTS	0.43	0.31	0.25
7410	TELEPHONE & TELE	0.01	0.02	0.02
7411	TRAVEL-MOVING EXP	0.11	0.38	0.31
7412	PAYROLL TAXES	0.35	0.00	0.00
7413	BAD DEBTS	0.00	0.00	0.00
7414	FREIGHT & STORAGE	0.00	0.00	0.00
7415	CASH OVER & SHORT	0.00	0.00	0.00
7416	NCR MAINTANENCE HGRE	0.00	0.00	0.00
7417	RINA-TRAINING FEES	0.00	0.01	0.01
7418	COMPUTER SERVICES-JS	0.00	0.18	0.15
	TOT GENERAL & ADM EXPENSE	6.55	6.30	5.09
	ADVERTISING & PROMOTION			
7500	MISCELLANEOUS	0.01	0.00	0.00
7501	NATIONAL ADV FUND	0.15	0.16	0.13
7502	NEWSPAPERS & MAGAZIN	0.00	0.01	0.01
7503	BILLBOARDS	0.26	0.14	0.11
7504	ON PREMISES SIGNS	0.28	0.28	0.22
	TOT ADVERTISING-PROMOTION	0.71	0.59	0.48
	REPAIRS & MAINTENANCE			
7600	CONTRACT LABOR-OTHER	0.13	0.11	0.09
7601	CONTRACT LABOR-POB	0.05	0.05	0.04
7602	PAYROLL-FAM-JIM	0.11	0.08	0.06
7603	AIR COND & HEATING	0.06	0.07	0.05
7604	BUILDINGS	0.01	0.00	0.00
7605	CONTRACT SERVICES	0.02	0.00	0.00
7606	ELECTRICAL & MECHAN	0.05	0.10	0.08
7607	FURNISHINGS	0.01	0.02	0.02
7608	LAUNDRY	0.05	0.00	0.00
7609	MISCELLANEOUS	0.02	0.00	0.00
7610	PAINTING & DECORATNG	0.01	0.00	0.00
7611	PLUMBING	0.01	0.76	0.62
7612	POOL	0.04	0.35	0.28
7613	T.V. LEASE	0.08	0.08	0.06
7614	T.V. NON-LEASE	0.04	0.02	0.02
7615	PAYROLL-OUTSIDE	0.00	0.00	0.00
7616	GROUNDS MAINTANENCE	0.00	0.40	0.32
	TOTAL REPAIRS & MAINTENANCE	0.70	2.04	1.65
	UTILITIES			
7700	ELECTRICITY	0.31	0.54	0.44
7701	NATURAL GAS	0.20	0.63	0.51
7702	SEWER & GARBAGE	0.03	0.08	0.06
7703	WATER	0.13	0.05	0.04
	TOTAL UTILITIES	0.76	1.30	1.05
	RESERVATION EXPENSE			
7800	RESERVATION FEES	0.11	0.00	0.00
7801	RAMADA TERMINAL	0.11	0.10	0.08
	TOTAL RESERVATION EXPENSE	0.22	0.10	0.08
	INSURANCE-TAXES-DEPRECIATION			
7900	WORKMENS COMP INS	0.07	0.00	0.00
7901	GENERAL INS EXP	0.17	0.00	0.00
7902	PROPERTY TAXES	0.57	2.52	2.04
7903	DEPRECIATION EXP	3.07	3.02	2.45
7904	MORTGAGE INS	0.00	0.00	0.00
	TOT INS-TAXES-DEPREC	3.87	5.56	4.49
	TOTAL EXPENSES	17.74	22.74	18.06
	NET PROFIT(-) OR LOSS(+)	0.99	2.71	2.19
	CASH FLOW	1.27-	0.51	0.42

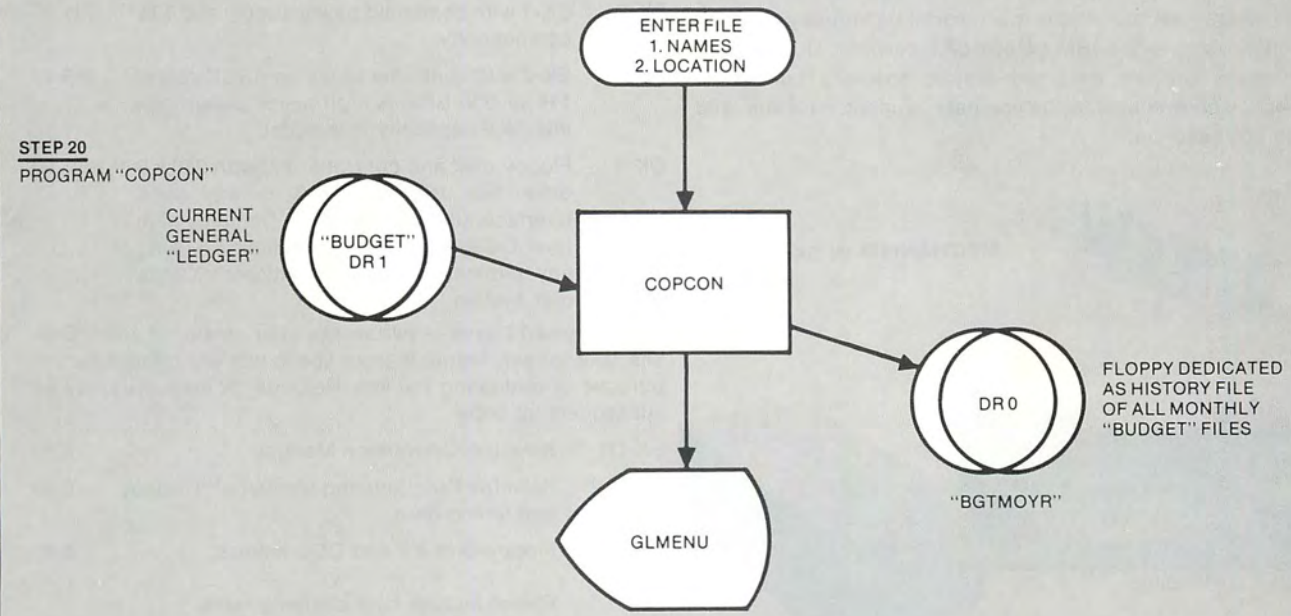
Monthly Step #19 — Copy Ledger Current to Ledger Backup



Terminal Inquiry Routine is the same as for Steps 4 and 7.

Monthly Step #20 — Copy Budget to BGTMOYR

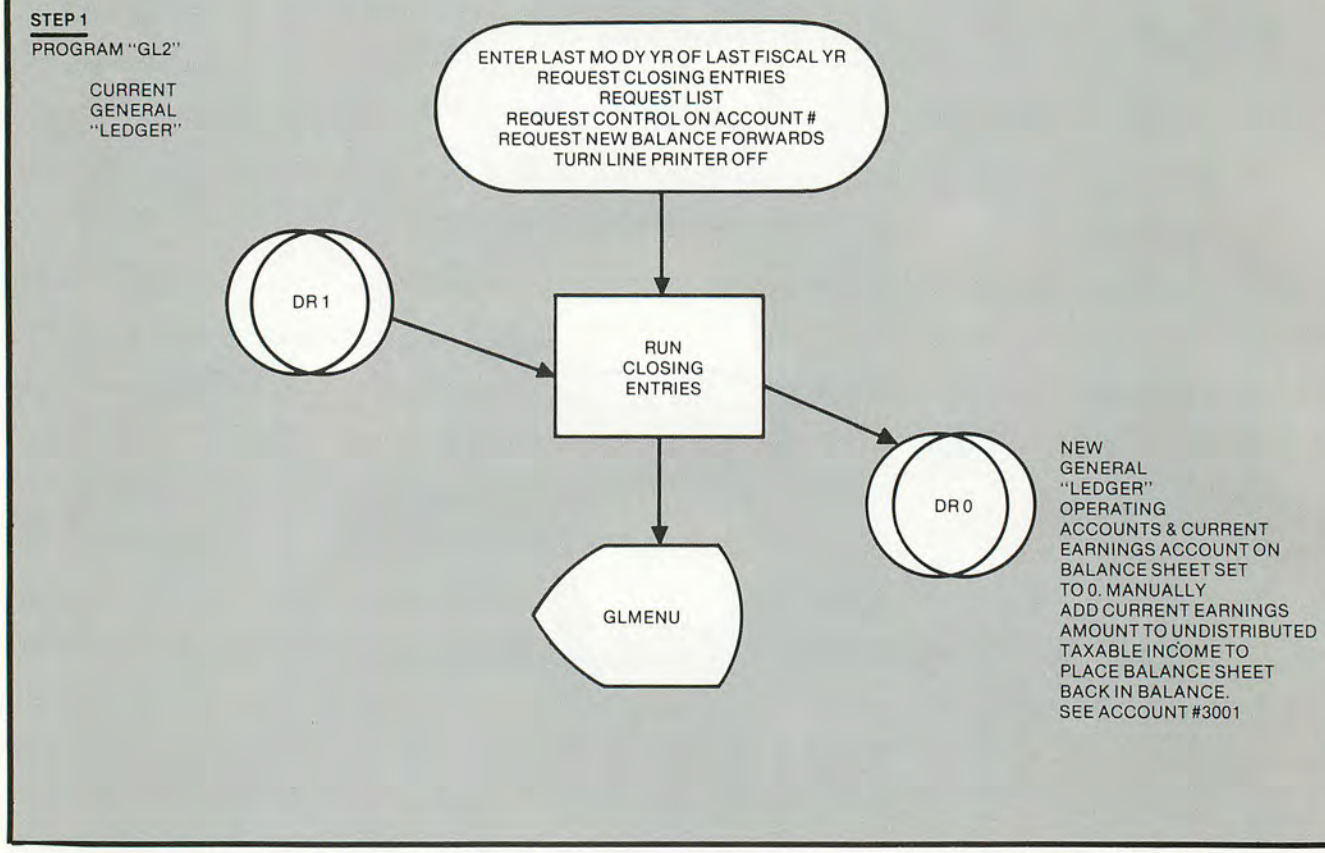
FLOW DIAGRAM



Terminal Inquiry Routine is the same as for Steps 4 and 7.

Year End Procedure Steps #1, 2, 3, 4 and 5

FLOW DIAGRAM



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STAR-SHIP SIMULATION

Part III of III

By Roger C. Garrett*

This is Part III of a three-part presentation. Part I published in the August issue defined simulation and discussed its uses. Part II covered systems objectives, such as developing a software system for a multi-operator STAR TREK game scenario. Part III concludes with the Logic Code Definitions and implementations and testing instructions.

—Editor

LOGIC FLOW DEFINITIONS

In Parts I and II, published in the previous two issues, I have described the methods employed in designing a simulation system and begun the definition of an extensive example: the STAR SHIP simulation. So far I have covered the overall objectives, major function identification and objectives, and the interfacing method. I will now cover the logic flow definitions.

Remember that I decided to write the entire logic flow utilizing structured programming constructs and that no actual code was to be written at that time. The purpose is to accurately define the entire system before any coding is done. This eliminates most of the need for the normal type of debugging required on projects which do not employ structured concepts.

The logic definitions are written in an easy-to-read English-like format. Read through them and note how the several modules interact through the use of common data. This may be a good time to go back to the previous issue and re-read the function definitions of each of the modules.

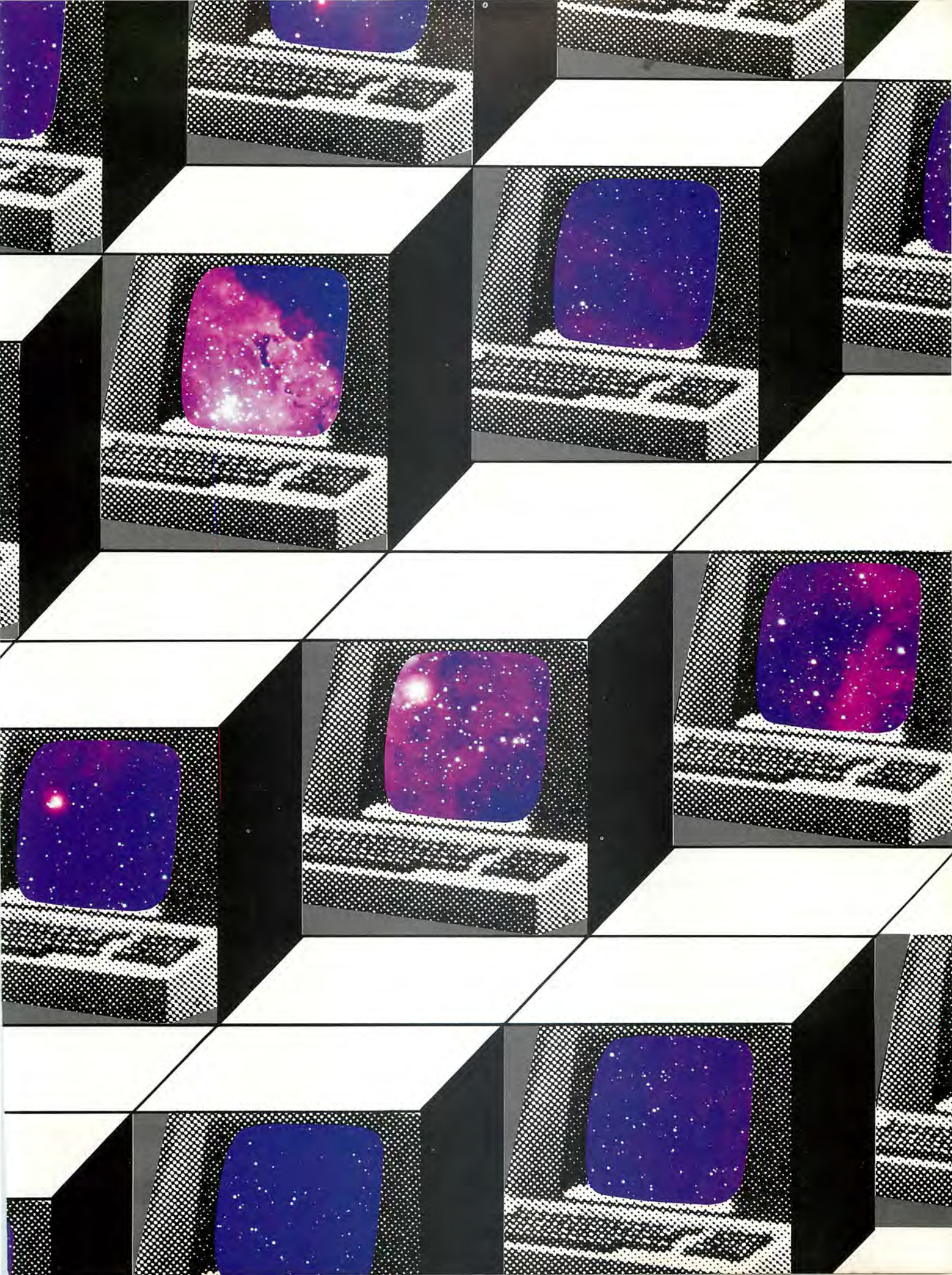
LOGIC FLOW DEFINITION (See Figure C.1)

```
<•••••COMMAND CONTROLLER MODULE (LEVEL 1)•••••>
REPEAT:
  CALL THE COMMAND CONTROLLER BACKGROUND SUBMODULE:
  CALL THE COMMAND CONTROLLER OPERATOR INPUT SUB-
  MODULE:
  CALL THE COMMAND CONTROLLER DISPLAY SUBMODULE.
UNTIL THE SYSTEM IS TURNED OFF
RETURN//

<•••••COMMAND CONTROLLER OPERATOR INPUT SUBMODULE
  (LEVEL 1)•••••>
IF THE COMMAND CONTROLLER ENTERED A COMMAND :
  IF THE COMMAND IS INITIALIZE ALL MODULES :
    SET THE INITIALIZATION FLAG FOR EACH MODULE .
  ORIF THE COMMAND IS INITIALIZE A PARTICULAR MODULE :
    CLEAR THE INITIALIZATION FLAG FOR THE PARTICULAR
    MODULE
  ORIF THE COMMAND IS ASSIGN A VALUE TO A PARTICULAR
  VARIABLE
    ASSIGN THE VALUE TO THE PARTICULAR COMMON DATA
    VARIABLE
  ORIF THE COMMAND IS RANDOMIZE A PARTICULAR VARIABLE :
    ASSIGN A RANDOM VALUE TO THE NAMED COMMON DATA
    VARIABLE
  ORIF THE COMMAND IS RANDOMIZE ALL COMMON DATA
  VARIABLES
    <RANDOMIZE THE VALUE OF ALL COMMON DATA VARIABLES
  ORIF THE COMMAND IS DISPLAY THE VALUE OF A VARIABLE :
    SET A FLAG .
  ORIF THE COMMAND IS DISPLAY THE VALUES OF ALL COMMON
  DATA VARIABLES OF A PARTICULAR MODULE :
    SET A FLAG .
  ORIF THE COMMAND IS INPUT A SCENARIO :
    READ IN THE SCENARIO .
  ORIF THE COMMAND IS RUN THE INPUT SCENARIO :
    IF THERE IS A SCENARIO :
      SET SCENARIO POINTER TO FIRST LINE IN SCENARIO :
      SET THE FLAG TO INDICATE THAT THE SCENARIO IS
      RUNNING
    ELSE THERE IS  NO SCENARIO :
      SO NOTIFY THE OPERATOR .
    ENDIF
  ORIF THE COMMAND IS HALT THE SCENARIO :
    CLEAR THE FLAG TO INDICATE THAT THE SCENARIO IS NOT
    RUNNING .
  ORIF THE COMMAND IS BEGIN EXECUTION OF A PARTICULAR
  MODULE
    IF THE INITIALIZATION FLAG FOR THE MODULE IS CLEAR :
      THEN SET THE RUN FLAG OF THE NAMED MODULE .
    ELSE THE INITIALIZATION FLAG FOR THE MODULE IS SET :
      SO NOTIFY THE COMMAND CONTROLLER OPERATOR .
    ENDIF
  ORIF THE COMMAND IS BEGIN EXECUTION OF ALL MODULES :
    IF ALL MODULE INITIALIZATION FLAGS ARE CLEARED :
      THEN SET THE MODULE EXECUTION FLAGS FOR ALL THE
      MODULES
    ELSE NOT ALL MODULE INITIALIZATION FLAGS ARE CLEARED :
      NOTIFY THE COMMAND CONTROLLER OPERATOR .
    ENDIF
  ORIF THE COMMAND IS HALT EXECUTION OF A PARTICULAR
  MODULE
    CLEAR THE EXECUTION FLAG OF THE PARTICULAR MODULE .
  ORIF THE COMMAND IS HALT EXECUTION OF ALL MODULES :
    CLEAR ALL EXECUTION FLAGS .
  ELSE THE COMMAND IS UNKNOWN :
    SO NOTIFY THE COMMAND CONTROLLER OPERATOR .
  ENDIF
ENDIF
RETURN//
 <•••••COMMAND CONTROLLER BACKGROUND SUBMODULE
   (LEVEL 2)•••••>
 CALL THE COMMAND CONTROLLER SCENARIO SUBMODULE :
 CALL THE ENGINEERING SUBMODULE :
 CALL THE COMMUNICATIONS SUBMODULE :
 CALL THE NAVIGATION SUBMODULE :
 CALL THE HELM SUBMODULE :
 CALL THE SCIENCES SUBMODULE :
 CALL THE MEDICAL MODULE .
 RETURN//

 <•••••COMMAND CONTROLLER DISPLAY SUBMODULE
   (LEVEL 2)•••••>
 < NOTE: THE DISPLAYED VALUES WILL CONTINUALLY BE UPDATED
 < ON THE DISPLAY SINCE THE FLAGS STAY SET UNTIL DYNAMICS
 < CHANGED BY THE COMMAND CONTROLLER OPERATOR .
 <
 IF A FLAG IS SET TO DISPLAY A VALUE OF A PARTICULAR VARIABLE
    THEN DISPLAY ITS NAME AND VALUE .
 ORIF A FLAG IS SET TO DISPLAY THE VALUES OF ALL VARIABLES
 ASSOCIATED WITH A PARTICULAR MODULE :
    THEN DISPLAY THEM .
 ENDIF
 RETURN//

 <•••••COMMAND CONTROLLER SCENARIO SUBMODULE
   (LEVEL 3)•••••>
 IF THE SCENARIO RUN FLAG IS SET :
    IF THE TIME SPECIFIED ON THE CURRENT SCENARIO LINE IS LESS
    THAN OR EQUAL TO THE REAL TIME :
      < THEN IT IS TIME TO EXECUTE THE CURRENT SCENARIO LINE
      EVALUATE THE LINE AND ASSIGN THE VALUE TO THE
      SPECIFIED VARIABLE :
      POINT TO THE NEXT SCENARIO LINE :
      IF THERE IS NO NEXT SCENARIO LINE :
        CLEAR THE SCENARIO RUN FLAG :
        NOTIFY THE COMMAND CONTROLLER OPERATOR .
      ENDIF
    ENDIF
 ENDIF
 RETURN//
```



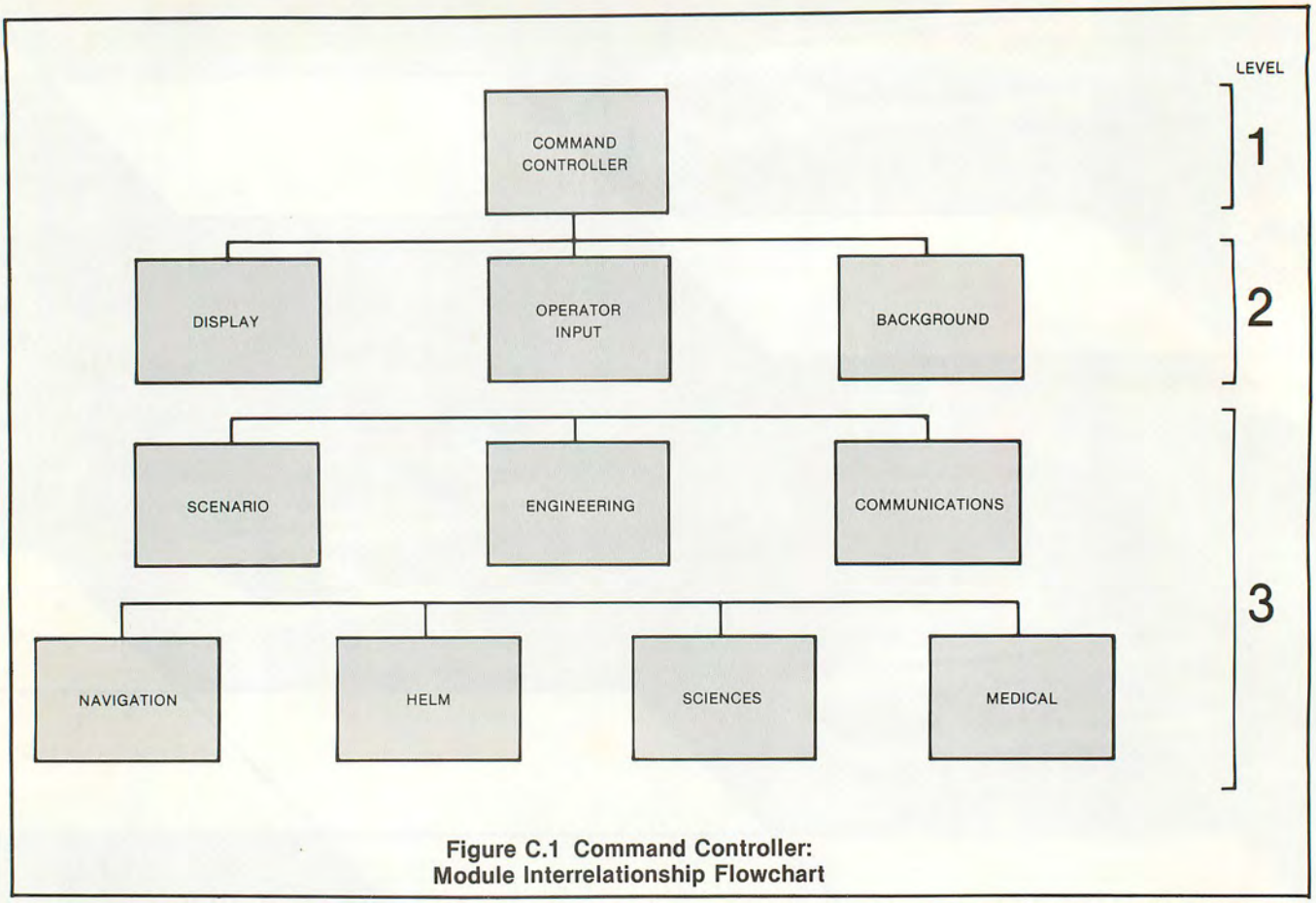


Figure C.1 Command Controller: Module Interrelationship Flowchart

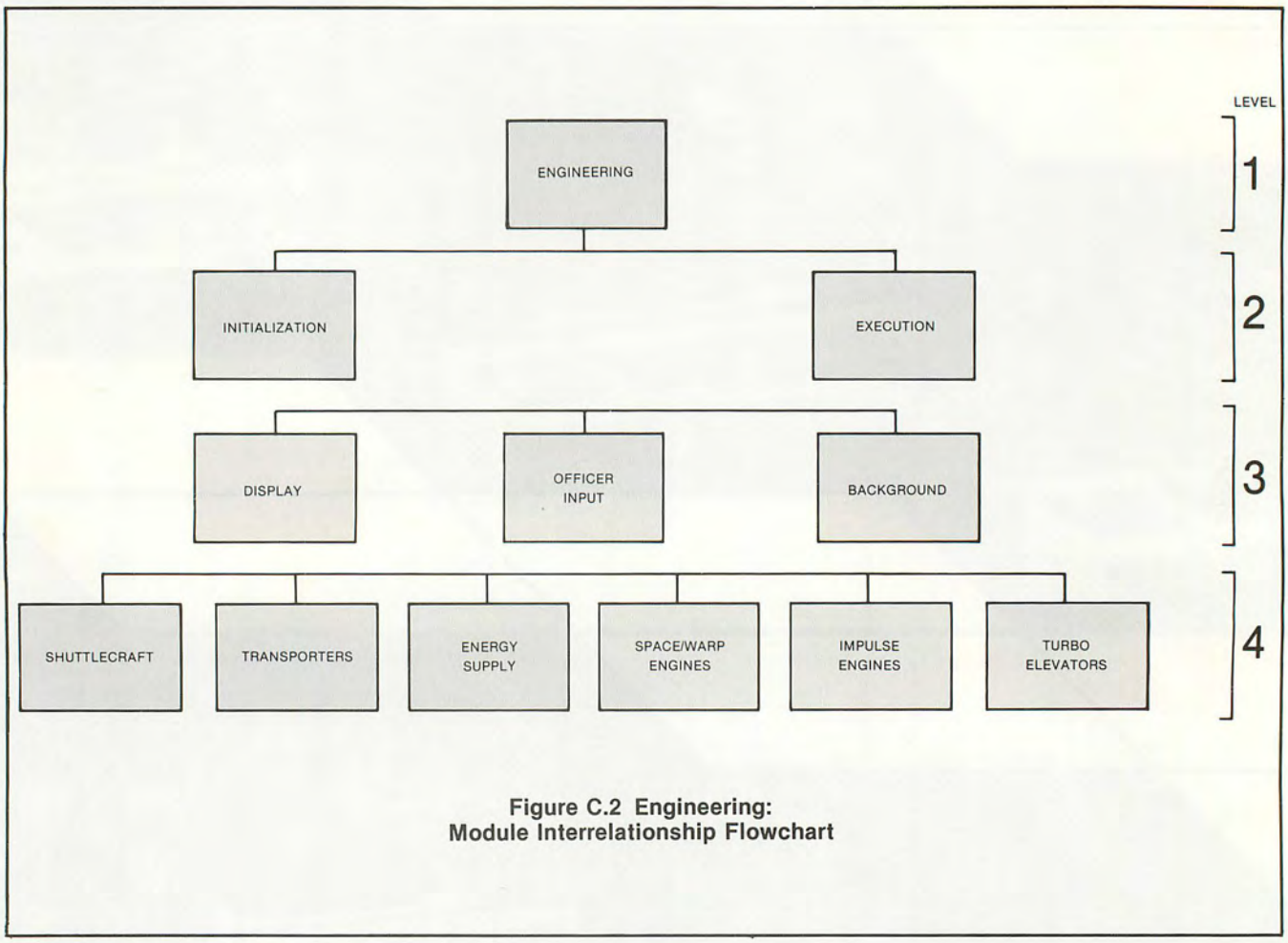


Figure C.2 Engineering: Module Interrelationship Flowchart

LOGIC FLOW DEFINITION (See Figure C.2)

```
<•••••ENGINEERING MODULE (LEVEL 1)•••••>
IF THE INITIALIZATION FLAG IS SET :
  CALL THE ENGINEERING INITIALIZATION SUBMODULE .
ELSE THE INITIALIZATION FLAG IS CLEAR :
  IF THE RUN FLAG IS SET :
    CALL THE ENGINEERING EXECUTION SUBMODULE .
  ENDIF
ENDIF
RETURN//

<•••••ENGINEERING INITIALIZATION SUBMODULE (LEVEL 2)•••••>
SET ALL ENGINEERING DATA TO NOMINAL :
CLEAR THE ENGINEERING INITIALIZATION FLAG .
RETURN//

<•••••ENGINEERING EXECUTION SUBMODULE (LEVEL 2)•••••>
CALL THE ENGINEERING BACKGROUND SUBMODULE :
CALL THE ENGINEERING DISPLAY SUBMODULE :
CALL THE ENGINEERING OFFICER INPUT SUBMODULE .
RETURN//

<•••••ENGINEERING BACKGROUND SUBMODULE (LEVEL 3)•••••>
CALL THE ENGINEERING SHUTTLECRAFT SUBMODULE :
CALL THE ENGINEERING TRANSPORTERS SUBMODULE :
CALL THE ENGINEERING ENERGY SUPPLY SUBMODULE :
CALL THE ENGINEERING SPACE/WARP ENGINES SUBMODULE :
CALL THE ENGINEERING IMPULSE ENGINES SUBMODULE :
CALL THE ENGINEERING TURBO-ELEVATORS SUBMODULE .
RETURN//

<•••••ENGINEERING DISPLAY SUBMODULE (LEVEL 3)•••••>
< UPDATE THE ENGINEERING DISPLAY
RETURN//

<•••••ENGINEERING OFFICER INPUT SUBMODULE (LEVEL 3)•••••>
< THE VALID ENGINEERING OFFICER COMMANDS ARE :
<  SET ENERGY SUPPLY TO A DEVICE
<  SET ENERGY SUPPLY TO A SHIP SECTION
<
IF THE ENGINEERING OFFICER HAS GIVEN A COMMAND :
  IF THE COMMAND IS SET ENERGY SUPPLY TO A DEVICE :
    SET THE ENERGY SUPPLY TO THAT DEVICE .
  ORIF THE COMMAND IS SET ENERGY SUPPLY TO A SHIP SECTION
    SET THE ENERGY SUPPLY TO ALL DEVICES IN THAT SECTION .
  ELSE THE COMMAND IS UNKNOWN :
    NOTIFY THE ENGINEERING OFFICER .
  ENDIF
ENDIF
RETURN//

<•••••ENGINEERING SHUTTLECRAFT SUBMODULE (LEVEL 4)•••••>
< UPDATE THE STATUS OF EACH OF THE SHUTTLECRAFT
< EACH SHUTTLECRAFT HAS A PARTICULAR MISSION. EACH MISSION
< HANDLED SEPARATELY
FOR I = 1 TO THE NUMBER OF SHUTTLECRAFT
  < UPDATE THE SHUTTLECRAFT'S X,Y POSITION
  IF THE SHUTTLECRAFT'S MISSION IS DELIVER CARGO :
    IF THE SHUTTLECRAFT HAS SUSTAINED SEVERE DAMAGE :
      NOTIFY THE ENGINEER :
      SET THE SHUTTLECRAFT'S MISSION TO 'NONE' :
        IF THE NEW POSITION COINCIDES WITH SOME OTHER
        OBJECT IN THE UNIVERSE :
          DELETE THE SHUTTLECRAFT FROM THE UNIVERSE :
          < REGISTER DAMAGE TO THE OBJECT
          CALL THE ENGINEERING INFLICT DAMAGE SUBMODULE .
        ENDIF
    ELSE THE SHUTTLECRAFT IS STILL OPERATIONAL :
      IF THE SHUTTLECRAFT HAS ARRIVED AT ITS DESTINATION :
        < REMOVE CARGO FROM THE SHUTTLECRAFT
        SET THE SHUTTLECRAFT'S MISSION TO 'MOVE TO NEW
        POSITION
        SET THE SHUTTLECRAFT'S DESTINATION TO 'ENTERPRISE' :
        DETERMINE AND SET THE VELOCITY VECTOR :
        UPDATE THE SHUTTLECRAFT'S X,Y POSITION .
      ELSE THE SHUTTLECRAFT HAS NOT REACHED ITS
      DESTINATION
        UPDATE THE SHUTTLECRAFT'S X,Y POSITION :
        UPDATE THE SHUTTLECRAFT'S VELOCITY VECTOR .
      ENDIF
    ENDIF
  ORIF THE SHUTTLECRAFT'S MISSION IS SEEK SENSOR DATA :
    UPDATE THE SHUTTLECRAFT'S X,Y POSITION :
    UPDATE THE SHUTTLECRAFT'S VELOCITY VECTOR :
    IF THE SHUTTLECRAFT HAS REACHED ITS DESTINATION
      UPDATE THE VELOCITY VECTOR TO ESTABLISH ORBIT .
    ENDIF
    < THE SENSOR CAPABILITY OF THE BRIDGE IS INCREASED AS
    < SHUTTLECRAFT GETS CLOSER TO ITS DESTINATION
    UPDATE THE BRIDGE SENSOR FUNCTIONAL CAPABILITY
    PROPORTIONAL TO THE DISTANCE BETWEEN THE SHUTTLECRAFT
    AND ITS DESTINATION .
  ORIF THE SHUTTLECRAFT'S MISSION IS TO TRANSPORT PERSONNEL
```

Figure 2. (Cont.)

```
   ELSE THE SHUTTLECRAFT HAS NO MISSION :
   ENDIF
 ENDFOR
 RETURN//

 <•••••ENGINEERING TRANSPORTER SUBMODULE (LEVEL 4)•••••>
 FOR I = 1 TO THE NUMBER OF TRANSPORTERS ON THE ENTERPRISE
   IF THERE IS SOMETHING TO BE TRANSPORTED :
     IF THE TRANSPORTER IS AT LEAST PARTIALLY FUNCTIONAL :
       < ATTEMPT TO TRANSPORT
       < THE SUCCESS OF ANY TRANSPORT IS RELATED TO THE
         FUNCTION
       < STATUS OF THE TRANSPORTER AND A RANDOM FUNCTION
       IF THE TRANSPORT WAS NOT SUCCESSFUL :
         DELETE THE OBJECT (CARGO OR PERSONNEL) FROM THE
         UNIVERSE
         NOTIFY THE ENGINEER
       ELSE THE TRANSPORT WAS SUCCESSFUL :
         UPDATE THE X,Y LOCATION OF THE OBJECT .
       ENDIF
     ELSE THE TRANSPORTER IS NOT FUNCTIONING :
       NOTIFY THE ENGINEER .
     ENDIF
   ENDIF
 ENDFOR
 RETURN//

 <•••••ENGINEERING ENERGY SUPPLY SUBMODULE (LEVEL 4)•••••>
 FOR I = 1 TO THE NUMBER OF LINKS IN THE ENERGY SUPPLY
 NETWORK
   UPDATE THE FUNCTIONAL STATUS OF THE LINK
   < FUNCTIONAL STATUS IS RELATED TO THE NUMBER,
     INTELLIGENCE
   < FUNCTIONAL, OPERATIONAL, AND HEALTH STATUS OF THE
   < MAINTENANCE PERSONNEL STATIONED AT THE ENERGY SUPPLY
   < LINK STATION .
 ENDFOR
 RETURN//

 <•••••ENGINEERING SPACE/WARP ENGINES SUBMODULE
   (LEVEL 4)•••••>
 IF THE SPACE/WARP ENGINES ARE ON :
   UPDATE THE ENERGY SUPPLY .
   < THE ENERGY CONSUMPTION OF THE SPACE/WARP ENGINES IS
   < RELATED TO THE VELOCITY AND FUNCTIONAL STATUS OF THE
   < ENGINES .
   UPDATE THE FUNCTIONAL AND OPERATIONAL STATUS OF THE
   SPACE/WARP ENGINES :
   < RELATED TO THE NUMBER, INTELLIGENCE, FUNCTIONAL,
   < OPERATIONAL, AND HEALTH STATUS OF MAINTENANCE
     PERSONNEL
   < STATIONED AT THE SPACE/WARP ENGINE.
 ENDIF
 RETURN//

<•••••ENGINEERING IMPULSE ENGINES SUBMODULE (LEVEL 4)••••>
IF THE IMPULSE ENGINES ARE ON :
  UPDATE THE ENERGY SUPPLY .
  <THE ENERGY CONSUMPTION OF THE IMPULSE ENGINES IS
  < RELATED TO THE FUNCTIONAL STATUS OF THE IMPULSE ENGINES
  < AND THE VELOCITY OF THE STAR SHIP
  UPDATE THE FUNCTIONAL AND OPERATIONAL STATUS :
  < RELATED TO THE NUMBER, INTELLIGENCE, FUNCTIONAL,
  < OPERATIONAL, AND HEALTH STATUS OF THE MAINTENANCE
  <PERSONNEL AT THE IMPULSE ENGINE STATION
ENDIF
RETURN//

<•••••ENGINEERING TURBO-ELEVATORS SUBMODULE
(LEVEL 4)•••••>
< UPDATE THE FUNCTIONAL STATUS OF EACH OF THE
< TURBO-ELEVATORS
< THE FUNCTIONAL STATUS OF EACH TUBE IS RELATED TO THE
< DELTA-TIME AND THE NUMBER OF MAINTENANCE PERSONNEL
< AT THE ELEVATOR TUBE
< UPDATE THE POSITION OF EACH TURBO-ELEVATOR
  FOR I = 1 TO THE NUMBER OF TURBO-ELEVATORS :
    IF IT HAS A DESTINATION :
      IF THE DESTINATION IS NOT BLOCKED BY A DAMAGED TUBE :
        UPDATE ITS POSITION
        < THE NEW POSITION IS RELATED TO THE TIME SINCE
        < THE LAST TURBO-ELEVATOR POSITION UPDATE
        IF THE DESTINATION HAS BEEN REACHED :
          SET THE DESTINATION TO 'NONE' :
          SET THE LOCATION OF ALL THE PERSONNEL ON THIS
          TURBO-ELEVATOR TO THEIR RESPECTIVE DESTINATIONS :
        ENDIF
      ELSE THE DESTINATION IS BLOCKED BY A DAMAGED TUBE :
        NOTIFY THE COMMUNICATIONS OFFICER :
      ENDIF
    ENDIF
  ENDFOR
< PERSONNEL MAY BE WAITING TO USE THE TURBO-ELEVATORS
FOR I = 1 TO THE NUMBER OF TURBO-ELEVATOR STATIONS :
  IF THERE IS PERSONNEL AT THE STATION :
    IF THERE IS A TURBO-ELEVATOR CAR AT THE STATION :
      PUT ONE PERSON ON THE TURBO-ELEVATOR CAR :
      SET THE DESTINATION EQUAL TO THE DESTINATION OF THE
      PERSON .
    ELSE THERE IS NO TURBO-ELEVATOR CAR AT THE STATION :
      < SO SEE IF ONE IS AVAILABLE TO MOVE TO THE STATION
      LOOK AT THE FIRST TURBO-ELEVATOR CAR :
      REPEAT
        IF IT HAS NO DESTINATION :
          SET ITS DESTINATION EQUAL TO THE STATION WHERE THE
          CAR IS WAITING .
        ELSE IT IS BEING USED :
          LOOK AT THE NEXT CAR .
        ENDIF
      UNTIL ALL CARS ARE CHECKED OR AN UNUSED CAR FOUND
    ENDIF
  ENDIF
ENDFOR
RETURN//

<•••••ENGINEERING INFLICT DAMAGE SUBMODULE (LEVEL 5)•••••>
< THE DAMAGE INFLICTED ON A TARGET IS RELATED TO THE
< FOLLOWING :
<
< WEAPON :
<    TYPE
<    FUNCTIONAL STATUS
<    OPERATIONAL STATUS
<    RELIABILITY FACTOR
< DISTANCE TO TARGET
<                    .
< THE CHOICE OF THE DEVICE THAT RECEIVES THE DAMAGE IS
< RELATED TO :
<
< RANDOM FUNCTION
< SHIELD SCREEN
<    FUNCTIONAL STATUS
<    OPERATIONAL STATUS
<    RELIABILITY FACTOR
<
< NOTE : DAMAGE CAN BE INFLICTED UPON ANY DEVICE OR PERSON
< THAT HAS 'FUNCTIONAL STATUS' AS AN ATTRIBUTE .
< DAMAGE CAN MEAN DECREASE IN ANY OF FUNCTIONAL STATUS,
< OPERATIONAL STATUS, RELIABILITY FACTOR, AND IN THE CASE OF
< PERSONNEL THEIR HEALTH STATUS (DEPENDING UPON THE
  WEATHER)
< FOR THE FOOD, WATER, AND AIR SUPPLIES THE QUANTITY, QUALITY
< AND POLLUTION LEVEL MAY BE AFFECTED.
RETURN//
```

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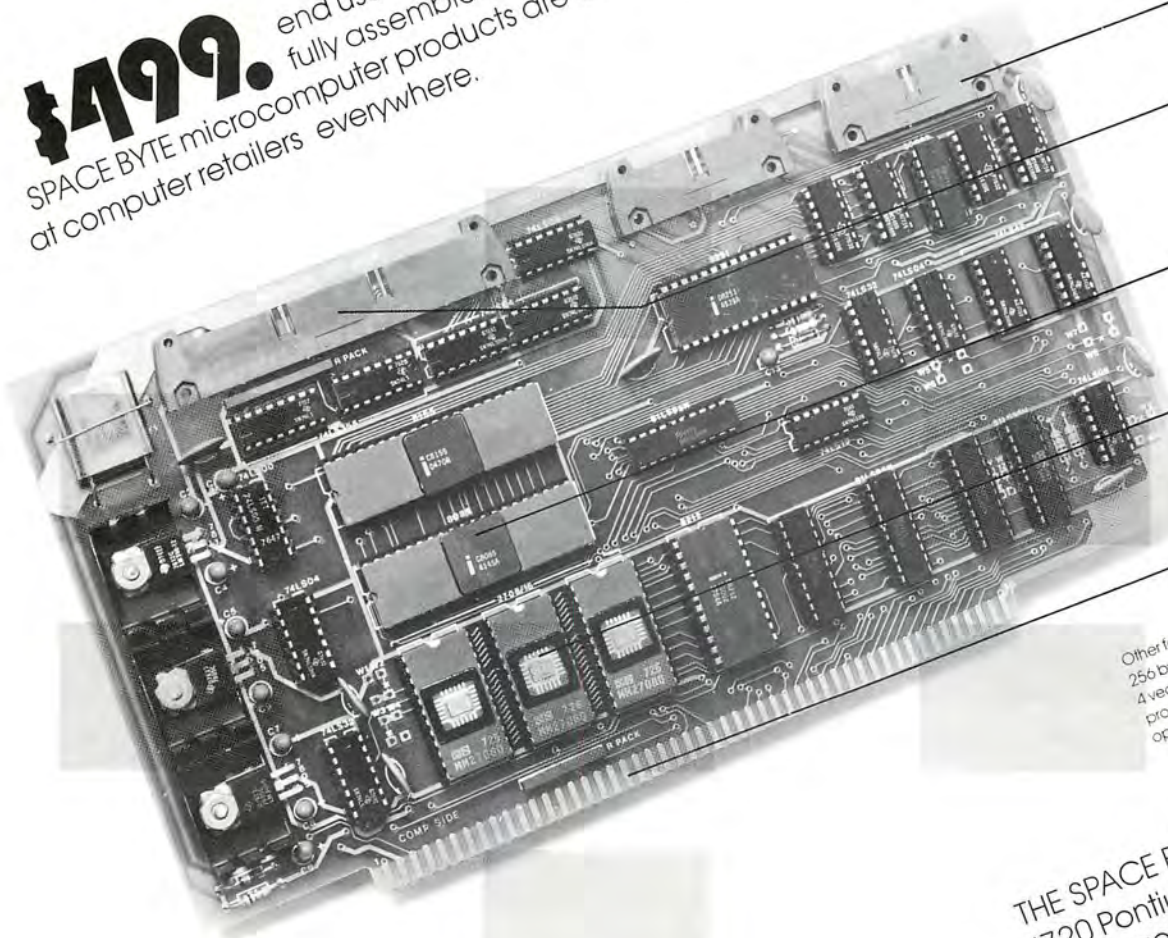

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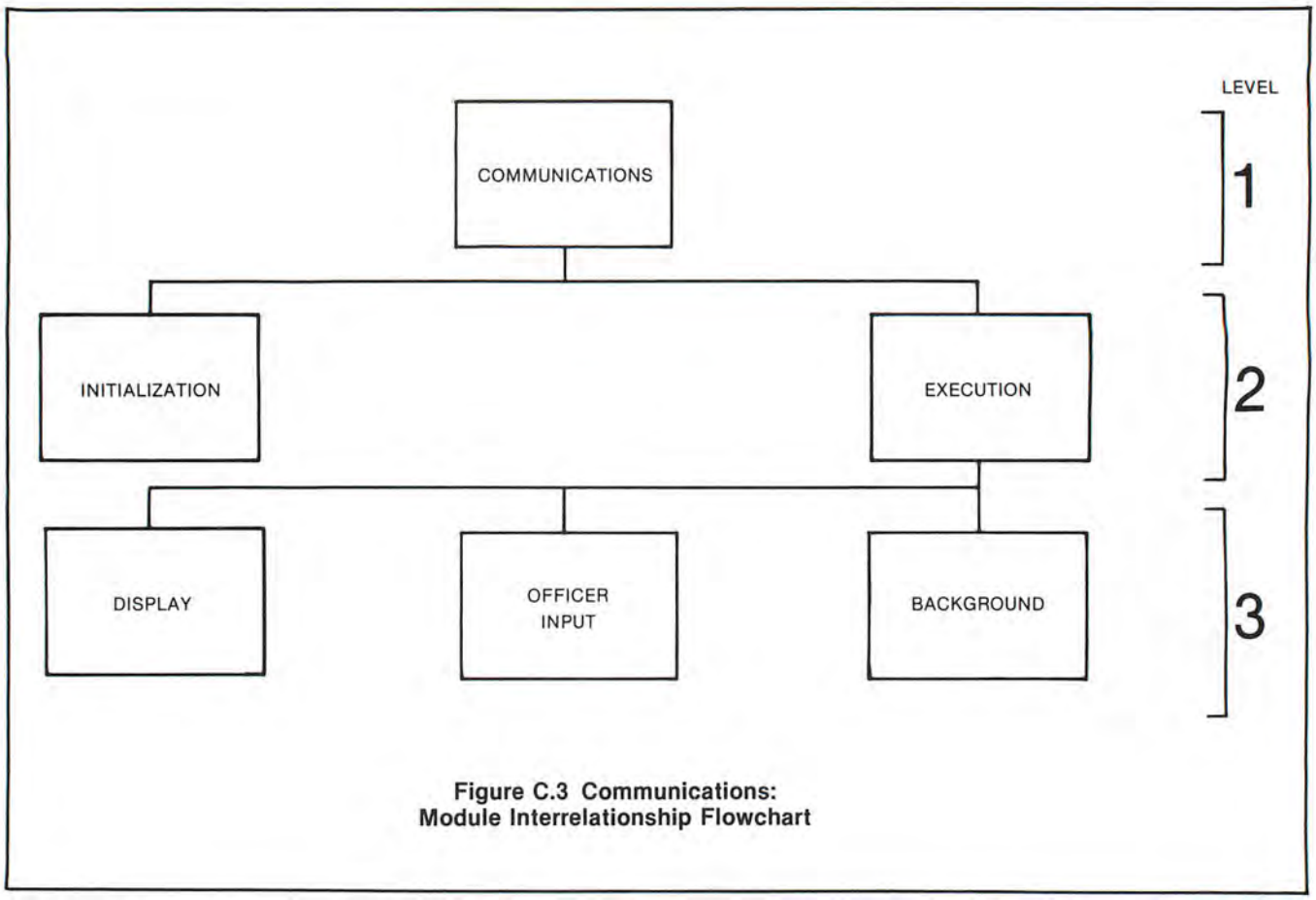


Figure C.3 Communications: Module Interrelationship Flowchart

LOGIC FLOW DEFINITION (See Figure C.3)

```
<•••••COMMUNICATIONS MODULE (LEVEL 1)•••••>
IF THE INITIALIZATION FLAG IS SET:
   CALL THE COMMUNICATIONS INITIALIZATION SUBMODULE.
ELSE THE INITIALIZATION FLAG IS CLEAR:
   IF THE RUN FLAG IS SET:
      CALL THE COMMUNICATIONS EXECUTION SUBMODULE.
   ENDIF
ENDIF
RETURN//

<•••••COMMUNICATIONS INITIALIZATION SUBMODULE
(LEVEL 2)•••••>
SET ALL COMMUNICATIONS DATA TO NOMINAL:
CLEAR THE COMMUNICATIONS INITIALIZATION FLAG.
RETURN//

<•••••COMMUNICATIONS EXECUTION SUBMODULE (LEVEL 2)•••••>
CALL THE COMMUNICATIONS BACKGROUND SUBMODULE:
CALL THE COMMUNICATIONS OFFICER INPUT SUBMODULE:
CALL THE COMMUNICATIONS DISPLAY SUBMODULE.
RETURN//

<•••••COMMUNICATIONS BACKGROUND SUBMODULE
(LEVEL 3)•••••>
FOR I = 1 TO THE NUMBER OF COMMUNICATIONS STATIONS:
   UPDATE THE OPERATIONAL STATUS OF THE STATION.
   < RELATED TO THE DELTA-TIME AND NUMBER OF MAINTENANCE
   < PERSONNEL AT THE STATION
ENDFOR
UPDATE THE OPERATIONAL STATUS OF THE ENTERPRISE'S INTER-
PLANETARY, AND INTRA-SHIP COMMUNICATIONS
< RELATED TO THE DELTA-TIME AND THE NUMBER OF MAINTENANCE
< PERSONNEL AT EACH POSITION
DECREASE THE ENERGY SUPPLY BY AN AMOUNT CORRESPONDING
TO COMMUNICATIONS ENERGY REQUIREMENTS.
< UPDATE THE STATUS OF ALL PERSONNEL ON THE ENTERPRISE
RETURN//

<•••••COMMUNICATIONS DISPLAY SUBMODULE (LEVEL 3)•••••>
UPDATE THE COMMUNICATIONS DISPLAY
<CHECK EACH OF THE POTENTIAL MESSAGE SENDERS TO SEE IF THEY
< ARE SENDING A MESSAGE
FOR I = 1 TO THE NUMBER OF POTENTIAL MESSAGE SENDERS:
   IF THEY HAVE A MESSAGE FOR THE ENTERPRISE:
      NOTIFY THE COMMUNICATIONS OFFICER:
      IF FLAG IS SET TO DISPLAY THE MESSAGE:
         DISPLAY THE MESSAGE:
         CLEAR THE ASSOCIATED DISPLAY MESSAGE FLAG:
         CLEAR THE ASSOCIATED MESSAGE AVAILABLE FLAG.
      ENDIF
   ENDIF
ENDFOR
RETURN//

<•••••COMMUNICATIONS OFFICER INPUT SUBMODULE
(LEVEL 3)•••••>
IF THE COMMUNICATIONS OFFICER ENTERED A COMMAND:
   IF THE COMMAND IS DISPLAY MESSAGE FROM SENDER:
      SET FLAG TO DISPLAY THAT MESSAGE.
   ORIF THE COMMAND IS TO SEND DISTRESS MESSAGE:
      SEND THE MESSAGE.
   ORIF THE COMAND IS TO REQUEST PERSONNEL MOVEMENT:
      SET DESTINATION OF NAMED PERSONNEL.
   ORIF THE COMMAND IS TO REQUEST AID FROM A FEDERATION SHIP
      SEND THE MESSAGE.
   ORIF THE COMMAND IS TO SEND PEACE TREATY OFFER TO ENEMY
      SEND THE MESSAGE.
   ORIF THE COMMAND IS TO ACCEPT PEACE TREATY OFFER FROM
   ENEMY
      SEND THE MESSAGE.
   ORIF THE COMMAND IS TO REJECT PEACE TREATY OFFER:
      SEND THE MESSAGE.
   ELSE THE COMMAND IS UNKNOWN:
      SO NOTIFY THE COMMUNICATIONS OFFICER.
   ENDIF
ENDIF
RETURN//
```

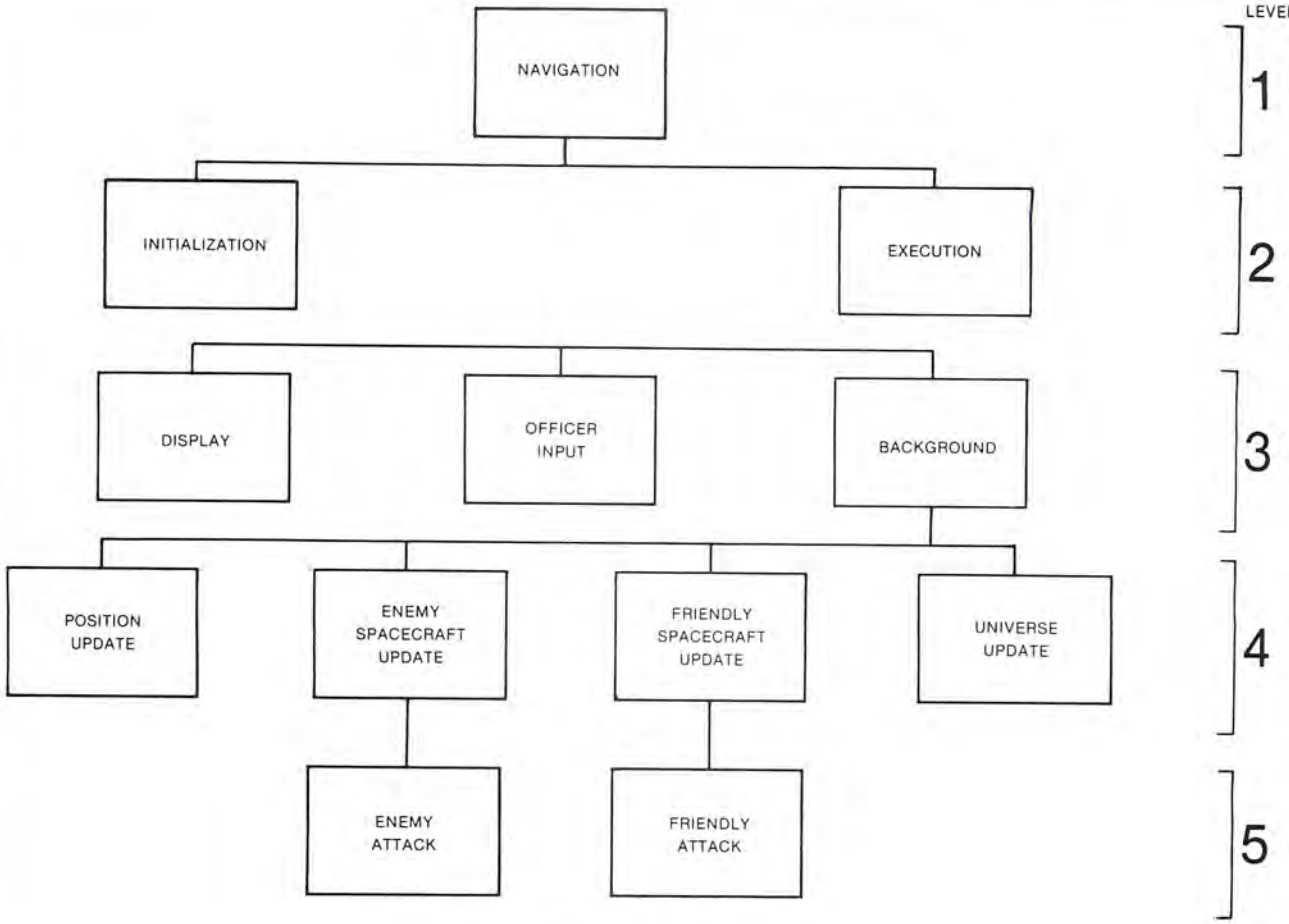


Figure C.4 Navigation:
Module Interrelationship Flowchart

LOGIC FLOW DEFINITION (See Figure C.4)

```
<•••••NAVIGATION MODULE (LEVEL 1)•••••>
IF THE INITIALIZATION FLAG IS SET :
   CALL THE NAVIGATION INITIALIZATION SUBMODULE.
ELSE THE INITIALIZATION FLAG IS CLEAR :
   IF THE RUN FLAG IS SET :
      CALL THE NAVIGATION EXECUTION SUBMODULE.
   ENDIF
ENDIF
RETURN//

<•••••NAVIGATION INITIALIZATION SUBMODULE (LEVEL 2)•••••>
SET ALL NAVIGATION VARIABLES TO NOMINAL :
CLEAR THE NAVIGATION SUBMODULE INITIALIZATION FLAG .
RETURN//

<•••••NAVIGATION EXECUTION SUBMODULE (LEVEL 2)•••••>
CALL THE NAVIGATION BACKGROUND SUBMODULE :
CALL THE NAVIGATION OFFICER INPUT SUBMODULE :
CALL THE NAVIGATION DISPLAY SUBMODULE .
RETURN//

<•••••NAVIGATION BACKGROUND SUBMODULE (LEVEL 3)•••••>
CALL THE NAVIGATION POSITION UPDATE SUBMODULE :
CALL THE NAVIGATION ENEMY SPACECRAFT UPDATE SUBMODULE :
CALL THE NAVIGATION FRIENDLY SPACESHIP UPDATE SUBMODULE
CALL THE NAVIGATION UNIVERSE UPDATE SUBMODULE .
RETURN//

<•••••NAVIGATION OFFICER INPUT SUBMODULE (LEVEL 3)•••••>
< THE NAVIGATION OFFICER HAS THE CAPABILITY TO SET COURSE
<
IF THE NAVIGATION OFFICER HAS GIVEN A COURSE CHANGE
COMMAND
   IF THE NAVIGATION COMPUTER IS FUNCTIONING AT ALL :
      IF THE NAVIGATION OFFICER HAS GIVEN A COURSE CHANGE
      COMMAND
      REQUIRING THE SPACE/WARP ENGINES :
         IF THE SPACE/WARP ENGINES ARE FUNCTIONING :
            SET THE VELOCITY VECTOR FOR THE REQUESTED
            COORDINATE
            INCLUDE AN ERROR PROPORTIONATE TO THE FUNCTIONAL
            STATE
            OF THE NAVIGATIONAL COMPUTER.
         ELSE THE SPACE/WARP ENGINES ARE NOT FUNCTIONING :
            SO NOTIFY THE NAVIGATION OFFICER.
         ENDIF
   ORIF THE NAVIGATION OFFICER HAS GIVEN A COURSE CHANGE
   COMMAND
   REQUIRING THE IMPULSE ENGINES :
      IF THE IMPULSE ENGINES ARE FUNCTIONING :
         SET THE VELOCITY VECTOR FOR THE REQUESTED
         COORDINATES
         INCLUDING AN ERROR CORRESPONDING TO THE
         FUNCTIONAL STATE
      OF THE NAVIGATIONAL COMPUTER.
      ELSE THE IMPULSE ENGINES ARE NOT FUNCTIONING :
         SO NOTIFY THE NAVIGATION OFFICER.
      ENDIF
ELSE THE NAVIGATIONAL COMPUTER IS NOT FUNCTIONING AT ALL
   SO NOTIFY THE NAVIGATION OFFICER.
ENDIF
RETURN//

<•••••NAVIGATION DISPLAY SUBMODULE (LEVEL 3)•••••>
UPDATE THE NAVIGATION DISPLAY
RETURN//

<•••••NAVIGATION POSITION UPDATE SUBMODULE (LEVEL 4)•••••>
< UPDATE THE X,Y COORDINATES OF THE ENTERPRISE >
< COMPUTE THE NEW X,Y COORDINATES USING THE PREVIOUS
< COORDINATE POSITION, THE VELOCITY VECTOR, GRAVITATIONAL
< FIELDS OF NEARBY PLANETS, BLACK HOLES, ETC. AND THE
< EFFECT OF TRACTOR BEAMS FROM OTHER CRAFT AND
< CIVILIZATIONS.
IF ANY OBJECT EXISTS BETWEEN THE PREVIOUS POSITION AND THE
NEW POSITION :
   THEN THE ENTERPRISE HAS BEEN DESTROYED :
      NOTIFY THE CAPTAIN OF THE END OF THE MISSION:
   NOTIFY THE COMMAND CONTROLLER TO TERMINATE THE MISSION.
ORIF THE ENTERPRISE IS ON A COLLISION COURSE WITH SOME
OBJECT
   NOTIFY THE NAVIGATION OFFICER OF THE TIME OF IMPACT AND
   POSSIBLE EVASIVE TACTICS.
ENDIF
RETURN//

<•••••NAVIGATION ENEMY SPACECRAFT UPDATE SUBMODULE
(LEVEL 4)•••••>
< LOCAL DATA :
<    OFFENSIVE WEAPONS :
<       WAIT TIME( )
<
FOR I = 1 TO THE NUMBER OF ENEMY SPACECRAFT :
   IF ITH ENEMY IS AN UNCONDITIONAL ATTACK TYPE :
      IF WITHIN FIRING RANGE OF A FRIENDLY CRAFT :
         IF WEAPONS ARE FUNCTIONAL :
            < NOTE THAT A WAIT TIME (RANDOM) IS REQUIRED BETWEEN
            < FIRING. THE WAIT TIME IS ESTABLISHED EACH TIME
            < THERE IS A SUCCESSFUL FIRING BY THE PARTICULAR
            < ENEMY. I.E. THERE IS A WAIT TIME FOR EACH WEAPON
            < ON EACH ENEMY CRAFT
            IF THE WAIT TIME HAS PASSED :
               CALL THE NAVIGATION ENEMY ATTACK SUBMODULE .
         ENDIF
      ENDIF
   ENDIF
   ORIF A FRIENDLY CRAFT HAS ATTACKED :
         CREATE A NEW ENEMY SPACECRAFT AT RANDOM
         COORDINATES
         WITH UNCONDITIONAL ATTACK STATUS AND DESTINATION
         COORDINATES NEAR THE FRIENDLY CRAFT :
         SET COURSE OF ITH ENEMY TOWARDS NEWLY CREATED
         ENEMY:
      ENDIF
   ENDIF
   ORIF THE ITH ENEMY IS A WEAPONS DELIVERY :
   ORIF THE ITH ENEMY IS ON A CONQUER CIVILIZATION MISSION
      IF NEAR A PLANET :
         ESTABLISH ORBIT .
      ORIF IN ORBIT AROUND A PLANET :
         IF WEAPONS ARE OPERABLE :
            IF ENERGY SUPPLY IS HIGH ENOUGH :
               FIRE ON THE CIVILIZATION :
               ADJUST DAMAGE LEVEL TO CIVILIZATION :
         ENDIF
   ENDIF
ENDFOR
UPDATE X,Y POSITION OF ENEMY CRAFT .
RETURN//

<•••••NAVIGATION FRIENDLY SPACECRAFT UPDATE SUBMODULE
(LEVEL 4)•••••>
FOR I = 1 TO THE NUMBER OF FRIENDLY CRAFT :
   IF ITH FRIENDLY IS AN UNCONDITIONAL ATTACK TYPE :
      IF WITHIN FIRING RANGE OF AN ENEMY CRAFT :
         IF WEAPONS ARE FUNCTIONAL :
            < NOTE THAT A WAIT TIME (RANDOM) IS REQUIRED BETWEEN
            < FIRING. THE WAIT TIME IS ESTABLISHED EACH TIME
            < THERE IS A SUCCESSFUL FIRING BY THE PARTICULAR
            < FRIENDLY. I.E. THERE IS A WAIT TIME FOR EACH WEAPON
            < ON EACH FRIENDLY CRAFT
            IF THE WAIT TIME HAS PASSED :
               CALL THE NAVIGATION FRIENDLY ATTACK SUBMODULE .
         ENDIF
      ENDIF
```

LFD for Figure C.4 continued on next page.

```
  ENDIF
  ORIF AN ENEMY CRAFT HAS ATTACKED:
       CREATE A NEW FRIENDLY SPACECRAFT AT RANDOM
       COORDINATES
       WITH UNCONDITIONAL ATTACK STATUS AND DESTINATION
       SET COURSE OF ITH FRIENDLY TOWARDS NEWLY CREATED
       FRIENDLY
    ENDIF
  ENDIF
  ORIF THE ITH FRIENDLY IS A WEAPONS DELIVERY:
  ORIF THE ITH FRIENDLY IS ON A CONQUER CIVILIZATION MISSION
    IF NEAR A PLANET:
      ESTABLISH ORBIT.
    ORIF IN ORBIT AROUND A PLANET:
      IF WEAPONS ARE OPERABLE:
        IF ENERGY SUPPLY IS HIGH ENOUGH:
          FIRE ON THE CIVILIZATION:
          ADJUST DAMAGE LEVEL TO CIVILIZATION:
      ENDIF
  ENDIF
ENDFOR
UPDATE X,Y POSITION OF FRIENDLY CRAFT.
RETURN//

<•••••NAVIGATION UNIVERSE UPDATE SUBMODULE (LEVEL 4)•••••>
FOR I = 1 TO THE NUMBER OF CELESTIAL OBJECTS IN THE UNIVERSE
  UPDATE THE VELOCITY VECTOR:
  UPDATE THE X,Y COORDINATES.
ENDFOR
RETURN//

<•••••NAVIGATION ENEMY ATTACK SUBMODULE (LEVEL 5)•••••>
FOR I = 1 TO THE NUMBER OF WEAPONS ON THE CURRENT ENEMY
  IF THE WAIT TIME FOR THE ITH WEAPON HAS PASSED:
    IF THE ITH WEAPON IS FUNCTIONAL:
      IF THERE IS SUFFICIENT ENERGY FOR THE ITH WEAPON:
        FIRE THE WEAPON AT THE FEDERATION SHIP:.
        UPDATE THE ENERGY SUPPLY OF THE ENEMY SHIP
        PROPORTIONAL
        TO THE ENERGY REQUIREMENT OF THE ITH WEAPON:
        < UPDATE THE DAMAGE STATUS OF THE FEDERATION SHIP
        UPDATE THE DAMAGE STATUS OF THE FEDERATION SHIP
        PROPORTIONAL TO THE OPERATIONAL STATUS OF THE
        DEFLECTOR SHIELDS OF THE FEDERATION SHIP, THE
        DESTRUCTIVE ENERGY OF THE ITH WEAPON, AND THE
        DISTANCE
        BETWEEN THE ENEMY SHIP AND THE FEDERATION SHP.
      ENDIF
    SET THE WAIT TIME.
    ENDIF
  ENDIF
ENDFOR
RETURN//

<•••••NAVIGATION FRIENDLY ATTACK SUBMODULE (LEVEL 5)•••••>
FOR I = 1 TO THE NUMBER OF WEAPONS ON THE FRIENDLY CRAFT
  IF THE WAIT TIME FOR THE ITH WEAPON HAS PASSED:
    IF THE ITH WEAPON IS FUNCTIONAL:
      IF THERE IS SUFFICIENT ENERGY FOR THE ITH WEAPON:
        FIRE THE WEAPON AT THE ENEMY CRAFT:
        UPDATE THE ENERGY SUPPLY OF THE FRIENDLY CRAFT
        PROPORTIONAL TO THE ENERGY REQUIREMENT OF THE
        ITH WEAPON
        < UPDATE THE DAMAGE STATUS OF THE ENEMY CRAFT
        UPDATE THE DAMAGE STATUS OF THE ENEMY CRAFT
        PROPORTIONAL TO THE OPERATIONAL STATUS OF THE
        DEFLECTOR SHIELDS OF THE ENEMY CRAFT, THE
        DESTRUCTIVE ENERGY OF THE ITH WEAPON, AND THE
        DISTANCE
        BETWEEN THE ENEMY SHIP AND THE FEDERATION SHIP.
      ENDIF
    ENDIF
  ENDIF
ENDFOR
RETURN//
```

LOGIC FLOW DEFINITION (See Figure C.5)

```
<•••••SCIENCES MODULE (LEVEL 1)•••••>
IF SCIENCES INITIALIZATION FLAG IS SET:
  CALL THE SCIENCES INITIALIZATION SUBMODULE.
ELSE THE SCIENCES INITIALIZATION FLAG IS CLEAR:
  IF THE RUN FLAG IS SET:
    CALL THE SCIENCES EXECUTION SUBMODULE.
  ENDIF
ENDIF
RETURN//

<•••••SCIENCES INITIALIZATION SUBMODULE (LEVEL 2)•••••>
SET ALL SCIENCES VARIABLES TO NOMINAL:
CLEAR THE SCIENCES SUBMODULE INITIALIZATION FLAG.
RETURN//

<•••••SCIENCES INITIALIZATION SUBMODULE (LEVEL 2)•••••>
CALL THE SCIENCES BACKGROUND SUBMODULE:
CALL THE SCIENCES OFFICER INPUT SUBMODULE:
CALL THE SCIENCES DISPLAY SUBMODULE.
RETURN//

<•••••SCIENCES BACKGROUND SUBMODULE (LEVEL 3)•••••>
<UPDATE THE STATUS OF THE SENSOR COMPUTER AND THE SENSOR
< ARRAY. THE STATUS OF EACH IS DEPENDENT UPON THE DELTA-TIME
< AND THE NUMBER OF MAINTENANCE PERSONNEL
RETURN//

<•••••SCIENCES OFFICER INPUT SUBMODULE (LEVEL 4)•••••>
IF THE SCIENCE OFFICER HAS GIVEN A COMMAND:
  <SCIENCE OFFICER COMMANDS ARE USED TO REQUEST SCIENCE
   DISPLAY
  <A PARTICULAR ENEMY, FRIEND, OR PLANET
  IF IT IS A COMMAND TO SCAN A PARTICULAR OBJECT:
    SET THE SCAN POINTER TO THE OBJECT.
  ORIF THE COMMAND IS TO SCAN AN AREA:
    SET THE SCAN POINTER TO THE AREA.
  ORIF THE COMMAND IS TO SCAN RANDOMLY:
    IF THE WAIT TIME HAS PASSED:
      SET THE POINTER TO A RANDOM AREA:
      SET THE WAIT TIME.
    ENDIF
  ELSE THE COMMAND IS UNKNOWN:
    NOTIFY THE SCIENCES OFFICER THAT HE HAS GIVEN AN
  UNKNOWN COMMAND:
  ENDIF
ENDIF
RETURN//

<•••••SCIENCES DISPLAY SUBMODULE (LEVEL 4)•••••>
< UPDATE THE APPROPRIATE PORTION OF THE DISPLAY.
< DEPENDENT UPON WHAT THE SCAN POINTER IS POINTING AT.
RETURN//
```

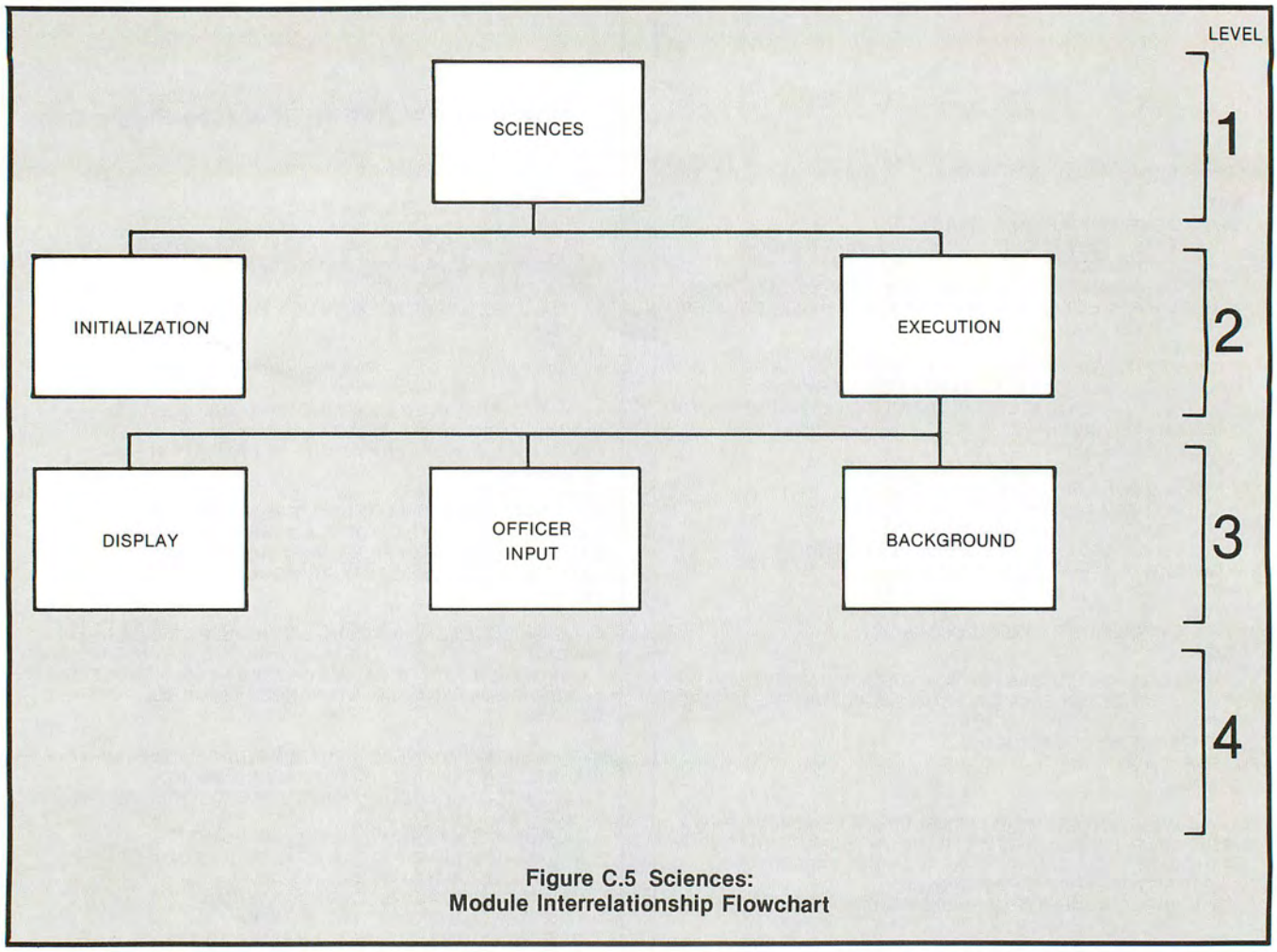


Figure C.5 Sciences:
Module Interrelationship Flowchart

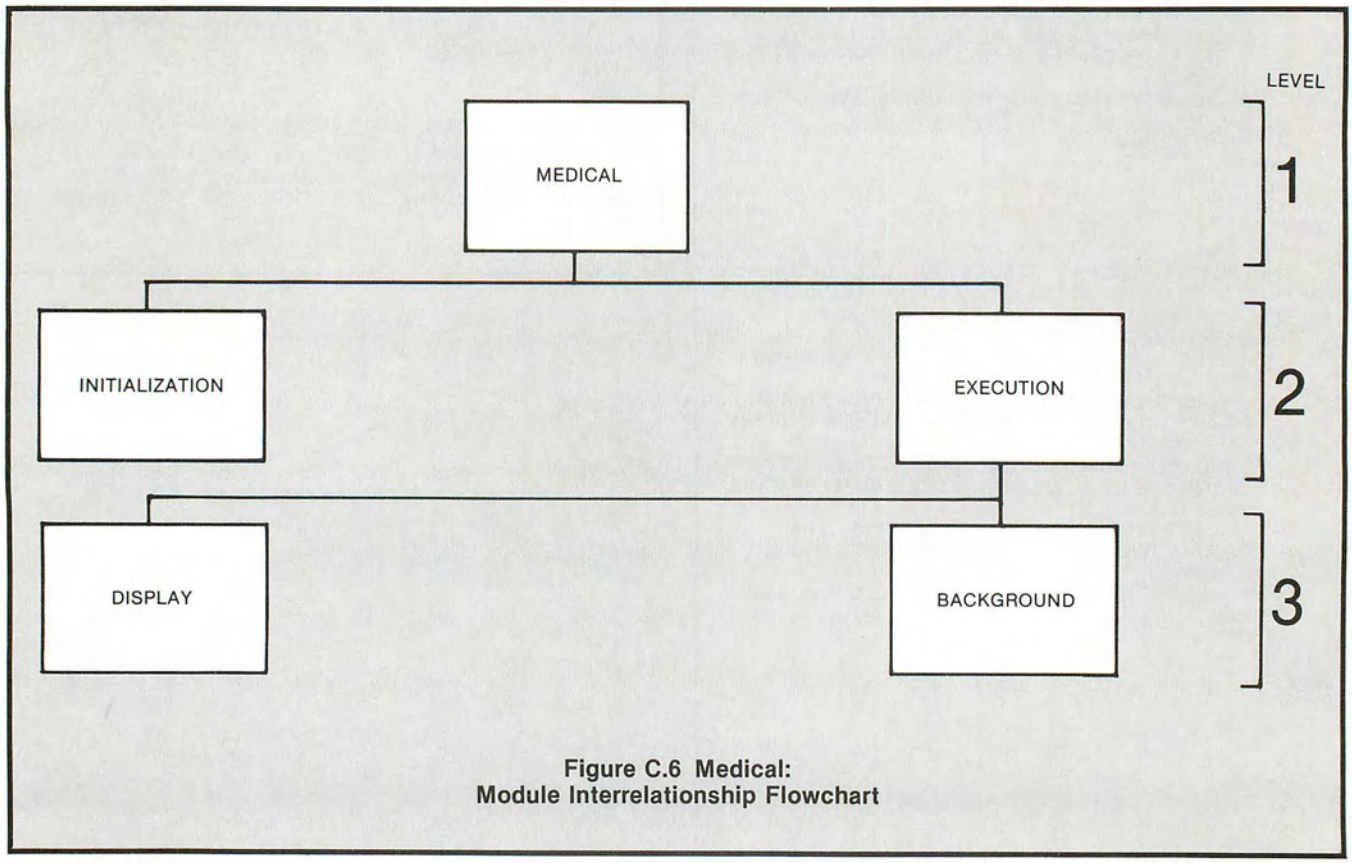
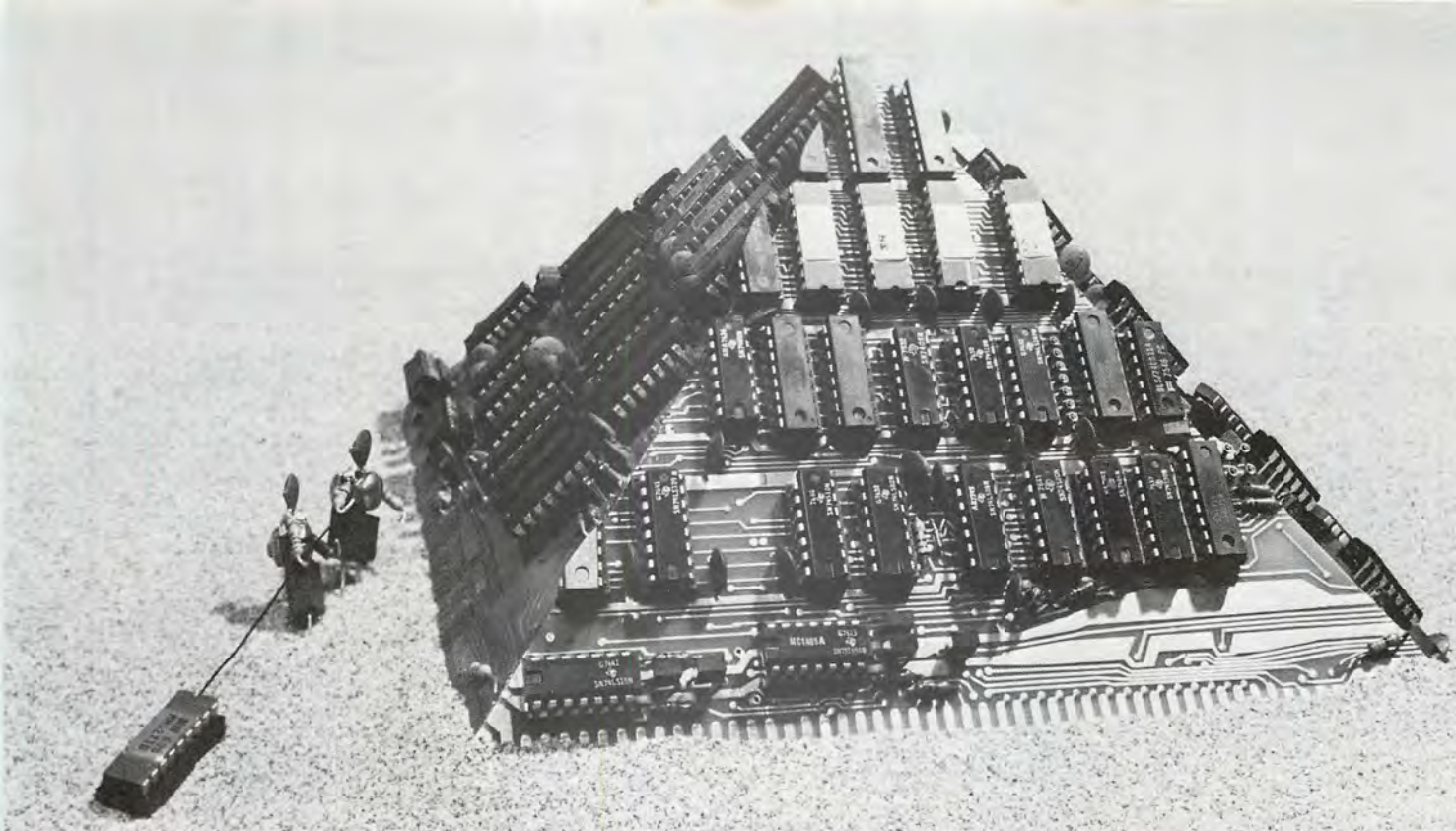


Figure C.6 Medical:
Module Interrelationship Flowchart



Dynabyte builds the Great Memory

We cut up a Dynabyte 16k dynamic RAM board and constructed this pyramid to illustrate an important point: Dynabyte designs and builds memory boards with the same unmatched engineering ability and technical skill that went into Egypt's Great Pyramid.

One of the seven wonders of the ancient world, the Great Pyramid has been standing on the desert for an incredible 4,400 years. Although its enormous base covers 13 acres, it is perfectly square. Rising 450 feet, it is as tall as a 37 story building. Over 2.3 million blocks of stone were used, each averaging 2½ tons. Some weigh 16 tons. Despite their size, they fit together with a tolerance that is less than half the width of a human hair.

Dynabyte builds its 16k dynamic RAM boards with the same exceptional precision and care. Their reliability is as solid as a rock.

Dynabyte's design meets rigid industrial grade standards. The design is so good, in fact, that one of the largest, most experienced electronics manufacturers has tried to imitate it. (We were flattered but not surprised; we know how good it is.)

More than 1400 microcomputer owners also know how good it is. Dynabyte's 16k dynamic is running in more systems than any other dynamic memory on the market.

We select the best components we can buy to build the 16k dynamic, because solid parts make a solid memory. Our memory chips, for example, are factory prime from National Semiconductor.

Dynabyte was the first to deliver 16k dynamic RAM's assembled, tested and burned in. And at a price competitive with kits! Each board's complete function is confirmed by three stages of testing and a burn in cycle that runs 72 hours at 70° C (158°).

When we build them that solid we can guarantee them for a full year.

If a Dynabyte board ever needs repair, we provide factory service with a 24 hour turnaround for both warranty and non-warranty work.

The Dynabyte 16k dynamic has the widest compatibility of any dynamic memory. So it will work in your system.

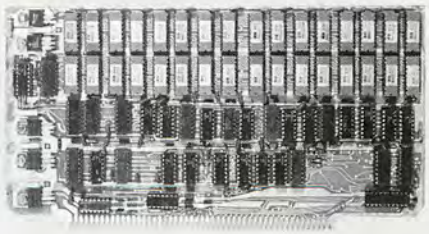
The Great Memory by Dynabyte is a solid buy. And an economical one. Effective October 1, the new Manufacturer's Suggested Price is reduced from $485 to $399.

Ask for the Great Memory by Dynabyte at your local computer store. If it isn't in stock, tell the owner that he missed another Dynabyte sale, and order direct. Telephone (415)494-7817. Cable DYNABYTE. Or mail to Dynabyte, Inc., 4020 Fabian, Palo Alto, CA 94303.

Specifications: 16,384 bytes, National Semiconductor MM5271 chips, S-100 compatible, 350 nsec. access time, 550 nsec. cycle time, transparent refresh, no wait states for 2 MHz 8080 processor, on board clock, 5 watts power consumption, 1 MHz direct memory access, 16k addressing, solder masked, assembled with sockets, tested, burned in, guaranteed one year.

Dynabyte

Builders of the Great Memory



LOGIC FLOW DEFINITION (See Figure C.6)

```
<•••••MEDICAL MODULE (LEVEL 1)•••••>
IF THE MEDICAL INITIALIZATION FLAG IS SET:
  CALL THE MEDICAL INITIALIZATION SUBMODULE.
ELSE THE MEDICAL INITIALIZATION FLAG IS CLEAR:
  IF THE MEDICAL MODULE RUN FLAG IS SET:
    CALL THE MEDICAL EXECUTION SUBMODULE.
  ENDIF
ENDIF
RETURN//

<•••••MEDICAL INITIALIZATION SUBMODULE (LEVEL 2)•••••>
SET ALL OF THE MEDICAL DATA TO NOMINAL:
CLEAR THE MEDICAL SUBMODULE INITIALIZATION FLAG.
RETURN//

<•••••MEDICAL EXECUTION SUBMODULE (LEVEL 2)•••••>
CALL THE MEDICAL BACKGROUND SUBMODULE:
CALL THE MEDICAL DISPLAY SUBMODULE.
RETURN//

<•••••MEDICAL BACKGROUND SUBMODULE (LEVEL 3)•••••>
UPDATE THE STATUS OF THE MEDICAL SECTION COMPUTER
UPDATE THE NUMBER OF INTENSIVE CARE UNITS AVAILABLE AND
FUNCTIONAL STATUS OF THE MEDICAL PERSONNEL IN THE MEDICAL
SECTION
< UPDATE THE STATUS OF THE PATIENTS IN THE MEDICAL SECTION
FOR I = 1 TO THE NUMBER OF PATIENTS IN THE MEDICAL SECTION
  IF THE RECOVERY TIME HAS PASSED FOR PATIENT I:
    UPDATE HIS FUNCTIONAL STATUS:
    IF HIS FUNCTIONAL STATUS IS NOT SATISFACTORY:
      RESET HIS RECOVERY TIME.
    ELSE HIS FUNCTIONAL STATUS IS SATISFACTORY:
      <SO SEND HIM TO HIS ASSIGNED STATION
    ENDIF
  ENDIF
ENDFOR
RETURN//

<•••••MEDICAL DISPLAY SUBMODULE (LEVEL 3)•••••>
UPDATE THE MEDICAL DISPLAY.
RETURN//
```

LOGIC FLOW DEFINITION (See Figure C.7)

```
<•••••HELM MODULE (LEVEL 1)•••••>
IF THE HELM INITIALIZATION FLAG IS SET:
  CALL THE HELM INITIALIZATION SUBMODULE.
ELSE THE HELM MODULE INITIALIZATION FLAG IS CLEAR:
  IF THE HELM SUBMODULE RUN FLAG IS SET:
    CALL THE HELM EXECUTION SUBMODULE.
  ENDIF
ENDIF
RETURN//

<•••••HELM INITIALIZATION SUBMODULE (LEVEL 2)•••••>
SET ALL HELM DATA TO NOMINAL:
CLEAR THE HELM INITIALIZATION FLAG.
RETURN//

<•••••HELM EXECUTION SUBMODULE (LEVEL 2)•••••>
CALL THE HELM BACKGROUND SUBMODULE:
CALL THE HELM OFFICER INPUT SUBMODULE:
CALL THE HELM DISPLAY SUBMODULE.
RETURN//

<•••••HELM BACKGROUND SUBMODULE (LEVEL 3)•••••>
<THE HELM MODULE HANDLES THE OFFENSIVE AND DEFENSIVE
 WEAPONS
<UPDATE STATUS OF HELMS SYSTEMS>
<OPERATIONAL STATUS OF PHOTON TORPEDO TUBES, PHASER BANK
<DEFLECTOR SHIELDS, ETC. ARE DEPENDENT UPON THE DAMAGE
<STATUS OF EACH OF THE CORRESPONDING SECTIONS OF THE
<ENTERPRISE AND THE ENERGY SUPPLY FOR EACH SECTION
< UPDATE THE STATUS OF THE HELM SYSTEMS
< THE FUNCTIONAL STATUS OF EACH OF THE TORPEDO STATIONS,
< PHASER STATIONS, AND DEFLECTOR SHIELD STATIONS IS
< PROPORTIONAL TO THE DAMAGE STATUS OF THE MAIN SHIP
< SECTION IN WHICH THEY RESIDE.
RETURN//

<PROCESS COMMANDS FROM THE HELMSMAN>
IF THE HELMSMAN GIVES A COMMAND:
  IF THE COMMAND IS TO FIRE A PHASER:
    IF THE PHASER BANK IS OPERATIONAL:
      IF THERE IS SUFFICIENT ENERGY TO FIRE THE PHASER:
        <FIRE THE PHASER AT THE REQUESTED TARGET OR
         COORDINATES
        IF THERE WAS AN OBJECT AT THE REQUESTED COORDINATES
        CALL THE HELM INFLICT DAMAGE SUBROUTINE.
      ELSE THERE IS INSUFFICIENT ENERGY TO FIRE THE PHASER
        NOTIFY THE HELMSMAN BY DISPLAYING A MESSAGE TO HIM.
      ENDIF
    ELSE THE PHASER BANK IS NOT OPERATIONAL:
      NOTIFY THE HELMSMAN BY DISPLAYING A MESSAGE TO HIM.
    ENDIF
  ORIF THE COMMAND IS TO FIRE A PHOTON TORPEDO:
    IF THE PHOTON TORPEDO TUBE IS FUNCTIONAL:
      IF THERE IS A PHOTON TORPEDO AT THAT TUBE:
        <FIRE THE PHOTON TORPEDO AT THE SELECTED TARGET>
        UPDATE THE NUMBER OF PHOTON TORPEDOS AT THAT TUBE:
        SET TRAJECTORY OF PHOTON TORPEDO:
        SET VELOCITY VECTOR OF PHOTON TORPEDO:
      ELSE THERE IS NO PHOTON TORPEDO AT THAT TUBE:
        NOTIFY THE HELMSMAN BY DISPLAYING A MESSAGE:
      ENDIF
    ELSE THE PHOTON TORPEDO TUBE IS NOT FUNCTIONAL:
      NOTIFY THE HELMSMAN BY DISPLAYING A MESSAGE TO HIM.
    ENDIF
  ORIF THE COMMAND IS TO RAISE DEFLECTOR SHIELD:
    IF THE DEFLECTOR SHIELDS ARE OPERATIONAL:
      IF THE DEFLECTOR SHIELD ENERGY SUPPLY IS SUFFICIENT:
        TURN ON THE DEFLECTOR SHIELD:
        SET THE ENERGY DRAIN INDICATOR.
      ELSE THE SHIELD ENERGY SUPPLY IS NOT SUFFICIENT:
        NOTIFY THE HELMSMAN BY DISPLAYING A MESSAGE TO HIM.
      ENDIF
    ELSE THE DEFLECTOR SHIELDS ARE NOT OPERATIONAL:
      NOTIFY THE HELMSMAN BY DISPLAYING A MESSAGE TO HIM.
    ENDIF
  ORIF THE COMMAND IS TO LOWER THE DEFLECTOR SHIELD:
    TURN OFF THE DEFLECTOR SHIELD:
    TURN OFF THE DEFLECTOR SHIELD ENERGY DRAIN INDICATOR.
  ELSE THE COMMAND IS UNKNOWN:
    NOTIFY THE HELMSMAN BY DISPLAYING A MESSAGE TO HIM.
  ENDIF
ENDIF
RETURN//

<•••••HELM DISPLAY (LEVEL 3)•••••>
UPDATE THE HELM DISPLAY.
RETURN//

<•••••HELM INFLICT DAMAGE SUBMODULE (LEVEL 4)•••••>
SAME AS OTHER DAMAGE SUBMODE
IF TARGET IS CONDITIONAL ATTACK TYPE:
  SET TARGET'S TYPE TO UNCONDITIONAL.
ORIF TARGET TYPE IS PEACEFUL MISSION:
  < CREATE A NEW ENEMY AT RANDOM COORDINATES WITH
    UNCONDITIONAL
  < ATTACK TYPE AND VELOCITY VECTOR TOWARDS ENTERPRISE:
  < SET COURSE OF ATTACKED CRAFT AWAY FROM THE ENTERPRISE
  < AT A RANDOM VELOCITY.
ENDIF
RETURN//
```

CODING THE LOGIC FLOW AND IMPLEMENTATION AND TESTING

LOGIC FLOW CODE

The logic flow has all been defined using comment or remark statements. What remains, then, is to translate it into actual code. Assuming a programming language has been chosen, the first task is to determine how to implement the features of the program which are not easily accomplished with the language. The problem of coding structured constructs in a non-structured language has already been covered in a previous issue. Two other major points need to be covered.

This simulation presupposes a separate CRT display and keyboard for each of the operators. Obviously this is a combination hardware/software problem. The hardware is solved by assigning a separate I/O port to each of the CRT/keyboards. The software solution depends upon the programming language chosen. In assembly language there is no problem since each module would have its own input/output subroutine. A high-level language is another story. If the implementation is on a large computer system then the high-level language may have the capability of executing direct code. This means, in effect, that assembly language statements can be included in the high-level code. The solution, then, is the same as if strictly assembly language is being used.

On microcomputer installations, since BASIC is the most generally used high-level language, the solution is different but no more difficult. The 'PEEK' and 'POKE' functions in MITS BASIC and comparable functions in other versions allow direct access to actual memory locations. The problem reduces to writing a BASIC subroutine for each of the modules that reads data from the associated input port and decodes them into text or numeric values and writes data out to the associated output port after decoding the text and numeric values into ASCII or display control characters. If CROMEMCO type displays are being used, then a separate memory area is assigned for each display and the output subroutines write out their data on to the appropriate memory area.

The other problem that must be resolved is the way in which INPUT statements are implemented in most forms of high-level languages and the way most programmers would initially implement them if they wrote their own. You may notice in the operator input submodules of the STAR SHIP simulation that there is a statement of the form IF THE OPERATOR ENTERED A COMMAND :. When the statement is true, i.e., when a command has been entered, the program processes the input. But, when no command has been typed the input processing section is skipped. In this way the entire simulation keeps running whether or not the operators are giving commands. It is this feature that makes the simulation appear to run in real-time. You will notice in most versions of STAR TREK (other than assembly language versions) that nothing happens until a command is typed. This is the problem with the INPUT statement. Each time it is executed the program comes to a stop until a carriage return is typed. If this procedure were used in this simulation the operators would be continually typing carriage returns, even when they had no comments to enter, in order to keep the simulation running properly.

What is needed to overcome this problem is an INPUT statement that reads from an input buffer. The buffer would get loaded by a subroutine that operates on interrupt. This is how it would work : a multi-byte input buffer is assigned for each of the modules. Whenever an operator types a character, the simulation program is interrupted—via a hardware interrupt line—and a special subroutine is called which reads in the character from the appropriate input port and puts it into its associated buffer. Then the simulation continues as if nothing happened. Whenever an INPUT statement is encountered the program reads from the buffer not the input port. It reads whatever is in the buffer and then deletes the contents of the buffer. If nothing was in there to read, then it

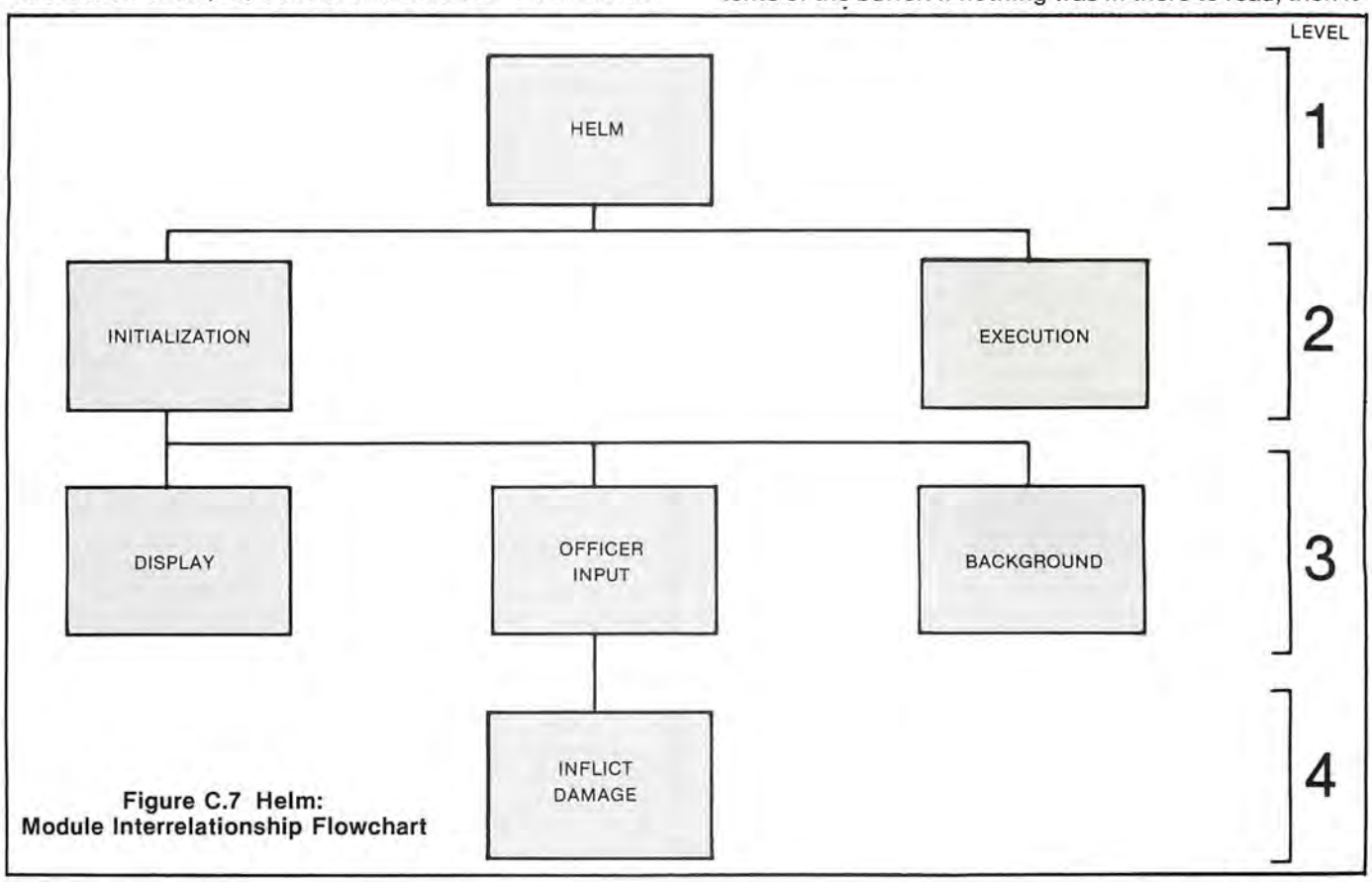


Figure C.7 Helm: Module Interrelationship Flowchart

reads nothing and perhaps returns a null character or a carriage return (depending upon the convention established by the programmer). The *important point is that* the INPUT doesn't halt the program if there is no input. The program can check to see if there was any input simply by checking for the null or carriage return.

There may be other implementation difficulties because of a particular language or hardware choice and each of these should be resolved before actual coding begins.

Now the conversion from logic flow definitions to programming language statements can begin. It is advisable to work top-down. Start with the Command Controller module and complete it first. Then continue to the other modules. It is also helpful to work top-down within each module and submodule. This means coding the outer-most structured programming constructions first and working towards the center. And always, *always* include the structured comments in the final source code.

TEST PROCEDURES

The modules should be tested top to bottom, as they are written. That is, the Command Controller and Common Data areas first. Testing of the top level can then be done by coding stubs for each of the remaining modules. A 'stub' is a module or subroutine which has an entry point and an exit point (return) but no actual code except, perhaps, for a tracing output message such as 'GOT TO THE MEDICAL MODULE'. Each of the subfunctions and operator commands should be tested separately, utilizing tracing functions for each. One particular type of trace would be one which writes out the common data variable values at critical points throughout the module so that it can be determined whether they are being updated properly.

Only after the Command Controller has been thoroughly checked should another module be added to replace its stub and then be checked out.

After all modules have been thoroughly debugged using tracing features, a sample scenario which will exercise all functions should be run (with traces still intact). The first scenario run should be done without any operator input. This test is to see if the module responds correctly to the scenario by itself. Observations are done by watching the trace output and the module displays. When it is certain that everything is working properly the full scale running of the system with or without the scenario and with full operator input can begin.

Trace functions should be removed as the programmer gains confidence in the associated modules. The final phase of testing is adjusting the constants and relationships which were initially educated guesses. This will include such things as how much damage should be done when a target gets hit by a phaser, how quickly the food supply should be consumed, the relationship of target mass to tractor beam operational status, and so on. Since in this simulation much of this information was not available during the design phase it now becomes the task of the programmer in conjunction with the operators to adjust the constants and relationships until the responses are 'realistic'. In this case, realistic means whatever the operators feel is reasonable and fair. Certainly allowing the STAR SHIP infinite energy or undamageable shield screens would be both unreasonable and unfair.

In other simulations which are designed to imitate actual known physical phenomena this part of the task is simplified since there is a set standard with which to compare the simulation output. For the STAR SHIP it is a bit more challenging, but then, there is freedom too, and the pleasure of creating your own universe.

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Product Preview

PROGRAMMER'S 8080 REFERENCE DATA HANDBOOK

To write a microcomputer program with machine codes is often tedious. Trying to convert the machine codes into OCTAL or HEX every time we do the program is often time-consuming. To figure out the machine codes for each different registers at each different instruction is often tedious and lengthy if we don't happen to make any mistakes. To check the kind of FORMAT it has to follow each time, is often neither quite refreshing. That's why there is a "Programmer's 8080 Reference Data Handbook" by West Pulse Engineering.

"Programmer's 8080 Reference Data Handbook" is written for every serious 8080 user — professional and novice alike. Saves time and money for programmers, engineers, and technicians on the production line, in the lab, or in the field.

It features cross listing for rapid assembly and debug of machine code and mnemonics. Convenient cross conversion of OCTAL, HEXADECIMAL with each instruction. The unique feature of this book is the classification of the FORMAT. In this book, the FORMAT has been classified as RR, MI, DA, DR, MR.

RR designates the transfer between registers or any single byte instruction.

MI designates "Move Immediate" which is a two-byte instruction, dealing with MEM and DATA, or REGISTER and DATA.

DA designated as DATA-ACC, which is a two-byte instruction implies the data movement with Accumulator.

DR designated as REG-DATA, which is a three-byte instruction with LOW-ORDER DATA and HIGH-ORDER DATA immediately following the OP CODE.

MR designated as REC-MEM, which is a three-byte instruction with LOW-ORDER ADDR and HIGH-ORDER ADDR immediately following the OP CODE.

The concise illustration of the FORMAT classification is shown in Figure 1.

This book has listed the 8080 instructions by functional groups: Data Movement, Arithmetic, Logical, Control, and Branching. A complete listing of the 8080 instructions by HEXADECIMAL and OCTAL order is provided. A listing by alphabetical order is also provided to ensure the maximum flexibility and efficiency of this handbook.

The notes about the unassigned OP CODE, full 128 character ANSI ASCII Code Table with HEXADECIMAL and OCTAL cross conversion, OCTAL and Decimal Conversion, Hexadecimal and Decimal Conversion, Powers of 2 and Powers of 16, Powers of 8, and Cross-Reference — Powers of 2, Powers of 8, Powers of 16 are also provided for convenient referring. Only a sample of the book contents is shown (Table 1) due to the thickness of the book, which makes it unsuitable to be all disclosed here.

For 30 more complete pages of reference data, please write to West Pulse Engineering, 14632 Erwin, Van Nuys, CA 91411. The price of the handbook is $7.95 each (plus postage and California sales tax) — 25% discounts for 3 or more. Dealer inquiry welcome.

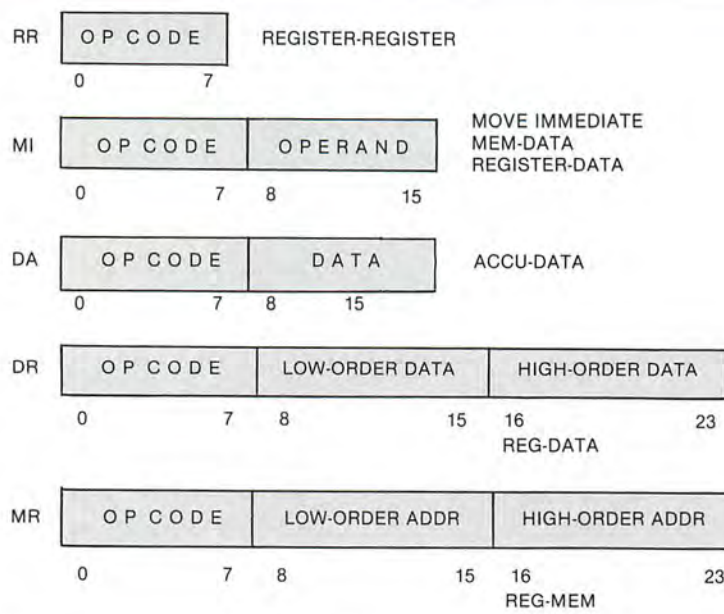


Figure 1. Format of 8080 Machine Instructions

MACHINE INSTRUCTIONS

MNEMONIC	OP CODE OCT	HEX	FORMAT	CLOCK CYCLE	NAME
ACI	316	CE	MI	7	Add with carry to Acc, immed
ADC A	217	8F	RR	4	Add with carry Reg A to Acc
ADC B	210	88	RR	4	Add with carry Reg B to Acc
ADC C	211	89	RR	4	Add with carry Reg C to Acc
ADC D	212	8A	RR	4	Add with carry Reg D to Acc
ADC E	213	8B	RR	4	Add with carry Reg E to Acc
ADC H	214	8C	RR	4	Add with carry Reg H to Acc
ADC L	215	8D	RR	4	Add with carry Reg L to Acc
ADC M	216	8E	RR	7	Add with carry Mem to Acc
ADD A	207	87	RR	4	Add Reg A to Acc
ADD B	200	80	RR	4	Add Reg B to Acc
ADD C	201	81	RR	4	Add Reg C to Acc
ADD D	202	82	RR	4	Add Reg D to Acc
ADD E	203	83	RR	4	Add Reg E to Acc
ADD H	204	84	RR	4	Add Reg H to Acc
ADD L	205	85	RR	4	Add Reg L to Acc
ADD M	206	86	RR	7	Add Mem to Acc
ADI	306	C6	MI	7	Add to Acc, immed
ANA A	247	A7	RR	4	AND Reg A with Acc
ANA B	240	A0	RR	4	AND Reg B with Acc
ANA C	241	A1	RR	4	AND Reg C with Acc
ANA D	242	A2	RR	4	AND Reg D with Acc
ANA E	243	A3	RR	4	AND Reg E with Acc
ANA H	244	A4	RR	4	AND Reg H with Acc
ANA L	245	A5	RR	4	AND Reg L with Acc
ANA M	246	A6	RR	7	AND Mem with Acc
ANI	346	E6	MI	7	AND with Acc, immed
CALL	315	CD	MR	17	Call uncond
CC	334	DC	MR	17/11	Call on carry
CM	374	FC	MR	17/11	Call on minus
CMA	057	2F	RR	4	Compliment Acc
CMC	077	3F	RR	4	Compliment Carry Flag
CMP A	277	BF	RR	4	Comp Reg A with Acc
CMP B	270	B8	RR	4	Comp Reg B with Acc
CMP C	271	B9	RR	4	Comp Reg C with Acc
CMP D	272	BA	RR	4	Comp Reg D with Acc
CMP E	273	BB	RR	4	Comp Reg E with Acc
CMP H	274	BC	RR	4	Comp Reg H with Acc
CMP L	275	BD	RR	4	Comp Reg L with Acc
CMP M	276	BE	RR	7	Comp Mem with Acc
CNC	324	D4	MR	17/11	Call on no carry
CNZ	304	C4	MR	17/11	Call on not zero
CP	364	F4	MR	17/11	Call on positive
CPE	354	EC	MR	17/11	Call on parity even
CPI	376	FE	MI	7	Comp with Acc, immed
CPO	344	E4	MR	17/11	Call on parity odd
CZ	314	CC	MR	17/11	Call on zero
DAA	047	27	RR	4	Decimal adjust Acc
DAD B	011	09	RR	10	Dbl Add B & C to H & L
DAD D	031	19	RR	10	Dbl Add D & E to H & L
DAD H	051	29	RR	10	Dbl Add H & L to H & L
DAD SP	071	39	RR	10	Dbl Add SP to H & L
DCR A	075	3D	RR	5	Decrement Reg A
DCR B	005	05	RR	5	Decrement Reg B
DCR C	015	0D	RR	5	Decrement Reg C
DCR D	025	15	RR	5	Decrement Reg D
DCR E	035	1D	RR	5	Decrement Reg E
DCR H	045	25	RR	5	Decrement Reg H
DCR L	055	2D	RR	5	Decrement Reg L
DCR M	065	35	RR	10	Decrement Mem
DCX B	013	0B	RR	5	Decrement extended B & C
DCX D	033	1B	RR	5	Decrement extended D & E
DCX H	053	2B	RR	5	Decrement extended H & L
DCX SP	073	3B	RR	5	Decrement SP
DI	363	F3	RR	4	Disable interrupts

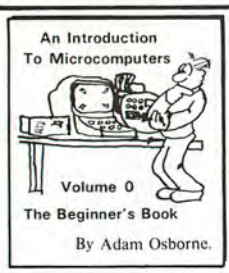
Table 1. 8080A Reference Data (Alphabetical Order)

OSBORNE & ASSOCIATES, INC.

The World Leaders In Microprocessor Books

Many books on microprocessors and their use are now on the market, and most of them have names that sound alike. But Osborne & Associates' books have dominated this market since 1975, when our first book appeared. With rave reviews from all over the world — with more than five hundred university text adoptions, our books are all best sellers. In fact, "An Introduction To Microcomputers: Volume I — Basic Concepts" now holds the world's record in sales volume for any textbook sold for a profit.

If you want information on microprocessors, begin with the Osborne books.



"An Introduction To Microcomputers: Volume 0 — The Beginner's Book" By Adam Osborne.

This is the book for the absolute beginner. Assuming that you know nothing about computers, math or science of any kind, this book explains what computers are all about — and it takes you to the point where you can read Volume I. 300 pages.
Book No: 6001 $7.50

For the microcomputer user, a series of books provide complete programs, written in BASIC. All these books are by Lon Poole and Mary Borchers.

"Some Common Basic Programs" 200 pages.
Book No: 21002 $7.50

"Payroll With Cost Accounting — In Basic". 400 pages Book No.: 22002 $12.50

"Accounts Payable and Accounts Receivable"
Book No.: 23002 $12.50 Available November 30, 1977

"General Ledger System"
Book No.: 24002 $12.50 Available December 31, 1977

"An Introduction To Microcomputers: Volume I — Basic Concepts" By Adam Osborne.

The world's best selling textbook. This book explains, clearly, concepts common to all microcomputers, yet specific to none. 350 pages.
Book No.: 2001 $7.50

"8080A and 8085 Assembly Language Programming" By Lance Leventhal.

This book is for the assembly language programmer or student; it explains assembly language programming for the 8080A and 8085 microcomputers. The book contains numerous examples. 400 pages.
Book No.: 31003 $7.50 Available October 31, 1977

"An Introduction To Microcomputers: Volume II — Some Real Products" (Revised June 1977) By Adam Osborne, Susanna Jacobson and Jerry Kane.

This book describes every common microprocessor and all of their support devices. Information is new and clearly written. Only data sheets are copied from manufacturers. 1200 pages.
Book No.: 3001 $15.00

The "Programming For Logic Design" series of books show how to use microprocessors in a digital logic environment.

"8080 Programming For Logic Design" By Adam Osborne. 300 pages.
Book No.: 4001 $7.50

"6800 Programming For Logic Design" By Adam Osborne. 300 pages.
Book No.: 5001 $7.50

"Z80 Programming For Logic Design" By Adam Osborne and Susanna Jacobson.
Book No: 7001 $7.50 (Available November 30, 1977)

OSBORNE & ASSOCIATES, INC. P.O. BOX 2036 BERKELEY, CA 94702 DEPT. C

TITLE	UNIT PRICE	QUANTITY
Volume 0 — The Beginner's Book (#6001)	$7.50 ea.	
Volume I — Basic Concepts (#2001)	$7.50 ea.	
Volume II — Some Real Products (#3001) revised 1977	$15.00 ea.	
8080 Programming For Logic Design (#4001)	$7.50 ea.	
6800 Programming For Logic Design (#5001)	$7.50 ea.	
8080A/8085 Assembly Language Programming (#31003)	$7.50 ea.	
Some Common BASIC Programs (#21002)	$7.50 ea.	
Payroll With Cost Accounting (#22002)	$12.50 ea.	

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NEW PRODUCTS

TELL-A-GRAF

Integrated Software Systems Corporation, developers of the DISSPLA computer graphics system, today announced a major new product, TELL-A-GRAF.

TELL-A-GRAF solves the traditional dilemma of providing publication quality, highly flexible graphics without requiring computer experts to use it. It does this by combining a highly sophisticated language processor, interpreting "natural language," English like commands, with the well-tried DISSPLA system, used at more than 100 installations to produce high quality graphics in business, scientific, mapping and typesetting applications.

The TELL-A-GRAF user might say

GENERATE A BAR CHART WITH A MONTHLY X AXIS. LABEL THE Y AXIS "DOLLARS," THE X AXIS "YEAR OF 1970," AND WRITE THE TITLE "ACME MANUFACTURING" "COST OF EVOLUTION" IN ITALIC LETTERING. FRAME THE PICTURE, AND COMMENT IT "SOURCE: BRANCH OFFICE REPORTS."

In addition to the brief commands, he would provide the input data, and the plot illustrated would result. A legend is automatically generated, the axes are scaled to fit the data, and headings, axis labels, etc. are automatically centered and positioned correctly.

TELL-A-GRAF simplifies the commands to generate the graph, while allowing modification and tailoring to fit special needs; the result is publication quality graphics. TELL-A-GRAF reduces report quality graphics to a matter of furnishing the data rather than being involved with the mechanics of laying out the form itself.

TELL-A-GRAF is intended both for organizations with a limited number of available programmers and for heavy graphics users who only wish to save programming effort. By giving the clerk, technician or manager direct control of the end result, TELL-A-GRAF also minimizes communication problems between the end users, computer experts, and art department personnel.

Computer graphics is now becoming available as an everyday tool, as easy to use as a printer. The great benefits of visual media, clarity, impact, and legibility, are already helping countless organizations, and are now available with substantially less effort.

By being based on DISSPLA, TELL-A-GRAF achieves not only output quality and flexibility, but also graphic device independence. Thus, different layouts, graph types, and annotation may be studied on interactive graphics terminals and the final result sent off to a high quality hardcopy device.

TELL-A-GRAF is under continuing development, and is currently offered on IBM Virtual Storage Systems. It is also available on the NCSS national service bureau. For further information, contact Integrated Software Systems Corporation, 4186 Sorrento Valley Blvd., Suite N, San Diego, CA 92121.

CIRCLE INQUIRY NO. 110

New Products to Support M6800 Microprocessor

Shifting Sands Microcomputer Products announces the release of several new products in support of the M6800 microprocessor. A new disassembler is available which generates labels and source tapes for the co-resident editor/assembler from SWTPC. Never before has this capability been available. Also being produced is a user programmable reset director which is designed for the SWTPC 68 computer system. The reset director enables the user to disable the MPU reset and interrupt vectors which normally go to MIKBUG and to direct them to one of three user defined addresses. The board solders to the SWTPC MP-A board in minutes. Reset to MIKBUG on power-up is standard. An EPROM converter is available which permits a 2708 EPROM to be plugged into the MIKBUG socket or other MC6830 type positions.

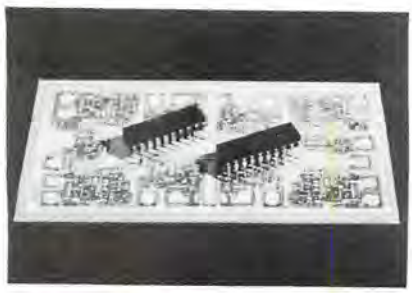
We are attempting to keep prices low to reach a wide market and to avoid the usual pirating problems. Registration is included with each software and firmware product.

For descriptions of these new products, and further information, contact Shifting Sands Microcomputer Products, Box 441, Fairborn, Ohio 45324.

CIRCLE INQUIRY NO. 111

First Devices of Octal Microprocessor Interface Family

An octal latch and octal register are the first devices in a family of interface circuits for use with high-performance bipolar and MOS microprocessor systems.



Both bipolar parts — the latch (SN74S373) and register (SN74S374) — are second sources for Texas Instruments' like-numbered standard Schottky TTL devices.

Designed in 20-pin space-saving "Skinny-DIPs," both the latch and register sell for $4.60 each in plastic packages at the 100-999 quantity level. Military versions (54S373, 54S374) are also available.

The latch and register feature three-state outputs designed to drive the high capacitance and low impedance required by long buses connecting processor, controller and I/O subsystems.

In addition to the standard TI parts, Monolithic Memories also offers three proprietary versions of both the latch and register: (1) High I_{OL}'s (32 mA, instead of the 20 mA offered on the similar Ti device); (2) inverting outputs, for bus applications such as interfacing the Am 2901A 4-bit slice to an active low bus; and (3) a device combining both 32 mA I_{OL}'s and inverting options. All three versions are drop-in replacements for TI's standard 54/74 parts.

For more information, contact Monolithic Memories, 1165 East Arques Ave., Sunnyvale, CA 94086, (408) 739-3535, ext. 111; or Tycer-Fultz, Palo Alto, CA, (415) 328-6300.

CIRCLE INQUIRY NO. 112

DIP Switch Features Locking Device

"Mini-DIP" features new locking design in which a .035 diameter locking rod is inserted through rockers, insuring against accidental actuation.

Easily actuated positive wiping Form A gold contacts are packaged in a dust free nylon housing. Interference-fit terminals, and one piece housing prevent contamination.

Guaranteed life of 50,000 cycles. Operating temperature range −10°C to +85°C, contact resistance 25 milliohms max. initial.

Standard .100 x .300 centers allows retrofitting of other major brands of DIP switches. Available in 2-10 station models.

Priced under $1.75 in 100 piece quantities. Six weeks delivery. EECO, 1441 East Chestnut, Santa Ana, CA 92701, Phone "Switch Products" (714) 835-6000.

CIRCLE INQUIRY NO. 113

S-100 "BUS GRABBING" Logic Analyzer

Called the Model 150 "BUS GRABBER," the instrument electrically and mechanically interfaces with the popular S-100 bus.

Packaging the analyzer's electronics on a standard S-100 type PC board provides significant cost savings and several unique features not previously possible. For example, 56 key signals on the bus can be monitored by the Model 150 without connecting or moving around the usual numerous and unwieldly input data probes associated with non-dedicated instruments. All the user has to do to gain access to the bus is plug the board into any spare slot of the computer main frame. Included in the 56 signals monitored are the address bus, the data bus, MPU status, interrupts and control signals.

Dedicating the analyzer to the S-100 bus also provides another significant advantage through the use of special circuitry on the PC board. This circuitry performs both automatic clock qualification and automatic clock polarity selection, thus eliminating several operator controls and reducing the time and effort required to obtain meaningful truth tables.

In addition to the 56 dedicated signals, the Model 150 offers 8 user-defined signals which interface to the PC board through an optional, plug-in, flat ribbon probe assembly. The associated probe tips are designed to interface with ball clips, wire wrap pins and IC clips, so that they can be used to monitor signals elsewhere in the computer or even in other, non-related, digital equipment. This optional cable assembly gives the user a full-functioning, fully independent 8-channel logic analyzer identical to the manufacturer's Model 100A.

Triggering, display formatting and operational modes of the Model 150 are controlled from a small hand-held pod connected to the main PC board through a ribbon cable. The trigger word can be up to 24 bits wide and each bit is set by miniature switches on the pod.

The analyzer's data memory is 16-bits wide by 16-words deep and can capture data at rates in excess of 8 million 16-bit words per second, permitting the Model 150 to be used with future, much faster S-100 bus computer systems as they become available.

Data words are displayed as ONE's and ZERO's on an ordinary oscilloscope which connects to the Model 150 through coaxial cables provided with the unit. And because of the large number of signals monitored—64 in all—the Model 150 simplifies data analysis by displaying the signals on the bus as a series of eight individual truth tables, each 8 bits wide by 16 words deep and each table selectable by a multiplexing switch on the control pod.

Using other controls on he pod, data can be formatted in HEX or OCTAL binary groupings; and individual truth tables can be stored indefinitely using the "snapshot" mode or continually updated using the repetitive mode. Another control permits the choice of post-trigger or pre-trigger data acquisition. In the post-trigger (positive time) mode, the trigger word appears intensified at the top of the screen with the next 15 words listed below. In the pre-trigger (negative time) mode, the trigger word is intensified at the bottom of the screen with the prior 15 words listed above. This last function is useful for hardware or software debugging when it is necessary to analyze the steps leading up to a problem such as an unwanted branch. Additional useful functions such as a trigger indicator LED (on the pod) and a trigger output signal—for real-time waveform analysis—round out the Model 150's versatile features.

The price for the Model 150 Bus Grabber in kit form is $369.00, while the assembled unit is $449.00. The optional external 8-bit data probe set is $9.95. Both the kit and assembled unit come with a comprehensive applications manual which can be purchased separately for $4.95.

For further information contact Paratronics, inc., 800 Charcot Avenue, San Jose, CA 95131, (408) 263-2252.

CIRCLE INQUIRY NO. 114

DP-1 Digital Pulser from CSC Cuts Hours from Troubleshooting Time

This inexpensive, hand-held unit, which draws power from the circuit under test, allows fast, easy exercising of digital circuits, with complete short circuit protection. After connecting the unit's clip leads to positive and negative power supply points, the user simply touches the DP-1 probe to a circuit node, and the unit's automatic polarity pulse sensing detects the circuit's condition—high or low state—triggering the unit to produce an opposite polarity pulse. Rapid, stimulus-response type troubleshooting is accomplished by using the pulser to inject signals at key points in TTL/DTL, CMOS and other popular circuits.

Testing with a single pulse, or with 100 pulses per second is possible via a simple pushbutton control on the DP-1, allowing the selection of single-shot or continuous modes. An LED indicator monitors the operating mode by flashing once for a single pulse, or continuous illumination for a pulse train.

Pulse width in the DP-1 is selectable to accommodate CMOS (10 μsec ±30%) or TTL/DTL (1.5 μsec ±30%) logic families. It provides CMOS circuits with a 50 mA source to logic 1, and a sink to logic 0. For TTL/DTL circuits, the DP-1 can be used as a 100 mA source up to 3.5V and a sink to .6V, for up to 60 loads. Rise time in the CMOS mode is 100 ns, fall time 8 μsec for a 100 K ohm load. (Fall time is directly proportional to load resistance.) In the TTL/DTL mode, rise time is also 100 ns, while fall time is 500 ns for one TTL load.

Short circuit protection on the DP-1 allows it to pulse into a short continuously without damage. The unit is also overvoltage protected to 25 volts and reverse-voltage protected up to 50 volts. Maximum current drawn is 30mA.

Conveniently compact, the pocket-sized DP-1 measures only 5.8" x 1.0" x 0.7" (147mm x 25.4mm x 17.8mm), and weighs only 3 oz. (.085 kg). For additional versatility, it accommodates plug-in, interchangeable test leads including "needle" probes, alligator clips, quick-attach hook clips and others to be announced.

At only $74.95 (manufacturer's recommended resale), the DP-1 provides a uniquely economical route to high-speed troubleshooting of digital circuits, for all types of design and testing applications. For more information, contact Continental Specialties Corporation, 44 Kendall Street, Box 1942, New Haven, CT 06509. (203) 624-3103.

CIRCLE INQUIRY NO. 115

Hexadecimal Keypad Accessory for MMD-1

Two data entry and display keypads have been introduced by E&L Instruments, Inc. as accessories for their Mini-Micro Designer (MMD-1) training and development microcomputer. One keypad is furnished with a two-digit hexadecimal LED display expandable to six digits. Both keypads are offered in assembled and kit form.

MMD/HEX-1 and MMD/HEX-2 keypads provide the MMD-1 user with a low-cost, convenient method for programming with the 4-bit binary hexadecimal code. The simple calculator-type 16-key array with eight additional function keys permits the user to execute programs, modify or examine the contents of memory and registers and monitor program performance. All keys are priority encoded.

A factory-programmed HEX L/D PROM for hexadecimal conversion replaces the HEX PROM originally supplied with the MMD-1. One pair of 0.3-inch high LED hexadecimal displays is furnished with each MMD/HEX-2 keypad and two additional pairs are optional. The 4 by 7 displays contain onboard latch, decoder and driver chips. Displays may also be added to the MMD/HEX-1 keypad. Both keypads are furnished with the conversion PROM, all integrated circuits, a 28-pin double-ended interconnection cable and instruction manual.

MMD/HEX keypads are 7¾-in. (19.7 cm) long by 4⅜-in. (11.4 cm) wide and 3-in. (7.6 cm) high and weigh approximately one lb. (0.45 kg).

The price for the assembled MMD/HEX-1 is $125.00 and in kit form it is $105.00. The price for the assembled MMD/HEX-2 is $185.00 and in kit form is $155.00, including the pair of displays. Delivery of MMD/HEX keypads is from stock. For further information contact E&L Instruments, Inc., 61 First St., Derby, CT 06418, (203) 735-8774.

CIRCLE INQUIRY NO. 116

Recorder Kit

A saturation recorder kit using TTL and wire-wrap technology. Using your own software, baud rates to 1200 and beyond are possible. Outperforms any audio cassette for the money. Kit includes gold sockets for all components, a cassette recorder, and an AC adaptor to supply current to the motor. All you supply is a serial I/O port, and + 5v for the circuit itself. All this can be yours for only $60.00, plus a little time. If you need a wire wrap tool, enclose an additional $6.00, but if you already have a cassette unit, knock off ten. Instructions are $6.00, refundable with order . . . And, if that's not enough, here's a real world interface. Using one 8-bit parallel output port, your computer can be put to work turning up to 126 devices on and off. Put your computer to work around the house! Each channel provides on-off control for one device for $22.50. You supply your own relay or optoisolator, guaranteeing that you get exactly what you want. Plans $5.00, refundable with order.

All prices less shipping costs. California residents add 6% sales tax. Send money orders to: R&B Model Shop, P.O. Box 92, Glendora, CA 91740. For additional information, send two bits and a S.A.S.E. Dealer inquiries invited, write ATTN: Inquiry.

CIRCLE INQUIRY NO. 117

M-200 Impact Matrix Printer

The M-200 uses a dual-column 7x7 half-dot matrix font and a logic-seeking, lookahead feature to achieve a print speed of 320 characters per second in a bidirectional print mode. This provides users with work throughputs ranging from 125 lines per minute with a full 132-character line to as many as 300 lines per minute with shorter 40-character lines. Average throughput is 200 lines per minute.

The M-200 has a large character set, including 96 standard ASCII characters as well as 32 commonly used international characters. It offers 132 print positions and can handle multi-part forms up to one original and five carbon copies. It has a sensor system that permits automatic printing to the bottom of the last form. Print ribbons come in handy easy-load cassettes and have an average life of five million characters.

An optional 11-position forms length select switch is available and a switch-selectable choice of printing at six or eight lines per inch is also available as an option.

The printer can be used worldwide as it may be ordered with a universal power supply to accommodate both the domestic 85-132V, 60Hz range and international 170-240V 50Hz power sources.

Standard interfacing with the M-200 printer is Dataproducts' parallel interface, but optional RS232C interfacing is available as well as off-the-shelf interfacing compatible with any other printer manufacturer's lines.

For further information on the new M-200 impact matrix printer or any of the company's other printers, write to Dataproducts Corporation, 6219 DeSoto Avenue, Woodland Hills, California 91265. (213) 887-8465.

CIRCLE INQUIRY NO. 118

Brochure Describes Full PDP-11 Computer Spectrum

Overview of PDP-11 computer family is covered in a new brochure, "PDP-11 Variations On A Theme." The booklet covers the PDP-11 from its entry-level PDP-11/03 packaged microprocessor to its "supermini" PDP-11/70, placing each computer in relation to other members of the family. It covers software, from assembler and utilities to sophisticated software packages such as DBMS-11. System packages, ranging from laboratory and communication systems to graphic systems are also detailed. PDP-11 related services such as maintenance are highlighted. For further information contact Digital Equipment Corporation, Maynard, Mass. 01754, (617) 897-5111, ext. 2777.

CIRCLE INQUIRY NO. 119

Molex Introduces Single Pinsetter with X-Y Table

Molex Incorporated is proud to announce the easiest single pinsetting unit in the world has become even easier. The new development of an X-Y table will make assembly line jobs faster and easier.

Standard .025 and .045 square wire pins are inserted in P.C. board at pin per second or operator's speed. For more information contact Molex Incorporated, 2222 Wellington Ct., Lisle, IL 60532, (312) 969-4550.

CIRCLE INQUIRY NO. 120

ON LINE

50 TO 1000 MEGABYTES

HARD DISK SUBSYSTEM

Introducing the AM-400—an S-100 compatible hard disk pack storage group that ranges from 50 to over 1000 megabytes on a single controller. Average access time is 28 milliseconds for fast response for real-time manipulation of files. The controller supports up to four Calcomp Trident drivers which may each contain from 25 to 300 megabytes of storage. These drivers require no special environment for reliable operation with maintenance available in most parts of the United States.

LANGUAGES

The software supplied is the tested AMOS* operating system which has been in use for over five years in various systems. It is a full timesharing multi-tasking system with device independent I/O. Languages supported include AlphaBasic, *LISP, and an extensive relocatable MACRO assembly subsystem. Access of files may be sequential or random with an ISAM subsystem. The entire software package is totally compatible without modification to the existing floppy disk based AMOS* system.

COMPATIBILITY

The AM-400* subsystem may run concurrently with the AM-200* floppy disk system or it may run independently as a mass-storage device in the system. An optional IPL loader PROM is available which will sequence up the AM-400* operating system directly from the Trident disk. This PROM must reside in an independent board such as a BYTESAVER or 2708 PROM board. The IPL loader program is included for the customer wishing it in some other form of ROM storage.

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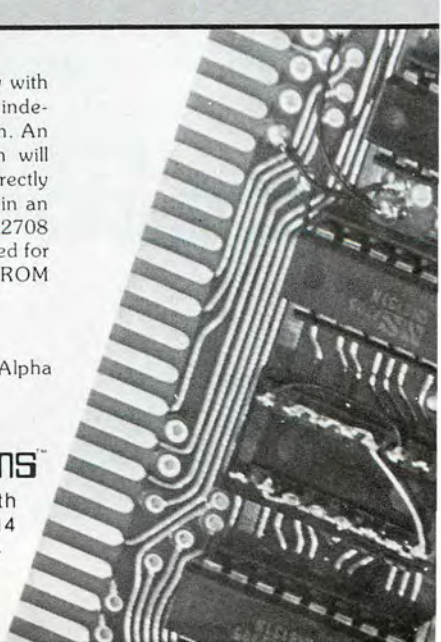
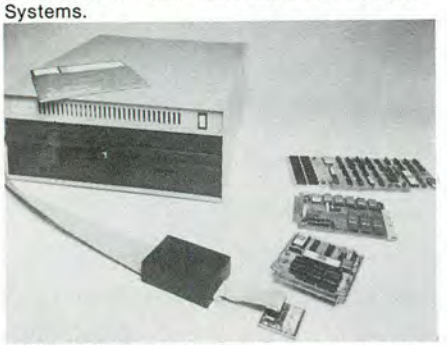


CIRCLE INQUIRY NO. 1

Emulation For Any Processor

The new emulation methodology was developed by M & E Associates and is to be manufactured and marketed by Digital Systems.



The Z-80 based development system combined the power of a special assembler with a memory emulation module to give the user the first truly "universal development system." The assembler allows the insertion of any instruction mnemonic including multibyte instructions like those of the Z-80. The user can set the assembler's symbol table for an 8080, F80, 6800, F8 and 6502, etc., and generate the appropriate object code. The object code is loaded into the emulator memory space where it can be executed by the target processor. No more compatibility problems between the emulators CPU (i.e., I8080) and target systems CPU (NEC 8080). A buffered connector plugs into the target systems' 2708 EPROM socket. Connectors for three (3) more 2708 chip selects allow the emulation of 4K bytes with the standard system.

Any target microcomputer system with a standard 2708 can be programmed and debugged using breakpoints. Once a program is debugged the user can program his 2708 EPROM via a RS-232 link.

Only one editor, one operating system, one assembler, and one set of utilities need be learned to develop software for the microprocessor of your choice. No needless waiting for an emulator system to use with your state-of-the-art processor.

The development/emulator system, including Z-80 CPU, 32K of RAM, 4K emulator RAM, dual floppy disc single density, will sell for $5,995. For further information write to M & E Associates, 10439 N. Stelling Road, Cupertino, CA 95014.

CIRCLE INQUIRY NO. 121

Miniature Power Supplies

Scientific Programming Inc., is introducing a new series of low cost but high performance miniature power supplies to meet the requirements of any microprocessor, RAM memory, ROM or PROM memory and any small system application. The new family called Micro-Supply (MS) is a new concept in miniature power supplies. The Micro-Supply family consists of a newly developed AC adaptor plus SPI's regulated converters. The AC adapter is a well plug-in unit designed to be compatible with all the converters manufactured by SPI. At the present time SPI is offering 9 types of regulated converters with dual or triple outputs. The most popular module is the TRIOUT 5/12/-5 which supplies +5 Volts (250mA), +12 Volts (100mA), and −5 Volts (100mA). Other voltages and currents are also available. The new power supplies can be ordered by adding the MS Prefix to the Converter part number.

The Micro-Supply Series is unusual in that they provide three output voltages and are thought to be the only commercially available modules with an overall height of less than 0.5 inch. The size, cost and performance of these units makes them ideal for P.C. Board mounting on small systems such as: CPU Boards, RAM Boards and PROM Boards.

Physical Dimensions: The converter portion of the Micro-Supply measures only 2.2" x 3.2" x 0.5" and it's encapsulated in a rigid case. The AC Adaptor is a wall plug-in unit and measures approximately 2" x 2" x 1.8".

Price and Availability: The most expensive Module is the MS TRIOUT 5/12/-5 at $69.00 in single quantity. Prices of other modules range from $39.95 to $69.00 depending on the type and the quantity. Considerable quantity discounts are available to volume users. Delivery is from stock to 4 weeks. For more information, write or call: Scientific Programming Inc., 1499 Bayshore Highway, Suite 126, Burlingame, CA 94010, (415) 493-2199.

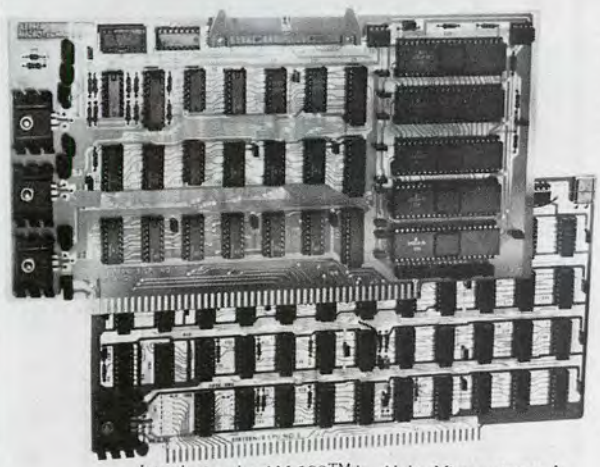
CIRCLE INQUIRY NO. 122

"GraphicAdd"

KEA Micro Design of Toronto has announced "GraphicAdd," a piggyback board for use in Sol computers and VDM-1 Video Display Modules. GraphicAdd gives graphics capability to these units (128H x 48V) and includes a Sol ready-to-load software package.

The GraphicAdd board mounts directly on VDM and Sol main boards. It works by replacing half of the inverse video character set by

PUT A MACRO IN YOUR MICRO!



Introducing the AM-100™ by Alpha Microsystems: A 16-bit microprocessor CPU (2-card set) that replaces the 8080 microprocessor in your S-100 bus type computer.

- Eight 16 bit registers
- Multi-level DMA and vectored interrupt system
- Real-time clock on the CPU board
- Hardware supported totally relocatable object code
- Multi-user/multi-tasking timeshared operating system
- Multi-user structured file system with passwords
- Multiple pass macro level assembler and linking loader
- Floppy disk file management system and utilities
- Up to 10 times the throughput of an 8080 system
- Fully supports most S-100 peripherals without modification
- ALPHA BASIC™ extended compiler and run system (not an interpreter)
- Free-form text editor and letter-writing text formatter
- System generation program to create custom operating system monitors
- Completely device independent with logical file I/O calls

TIMESHARING FOR A MICRO

Imagine playing Startrek to kill time while you wait for your computer to print out a complicated listing—but using the same computer.

Hardware limitations of the 8080 have made microcomputer timesharing impractical for the personal computer enthusiast. The AM-100™ 16-bit microprocessor set puts at your command a system which easily accepts multi-tasking from a multiple user structure. In addition the AM-100™ system lets you control priorities and allocate memory requirements for each job activated. There is even a security system to prevent unauthorized access to the data files (a Macro Computer?).

- Businessmen—put a terminal on the desk of your bookkeeper, stock clerk and design engineer. Perform the daily accounting, inventory control and design problems at the same time. Hook a terminal in the shop and audit production schedules with the processor's real-time clock.
- Teachers—have each student at a terminal at the same time running a learning program. Monitor the progress on your master terminal.
- OEM/Software Developers—create extremely fast executable object code format with source listing. Provide customized software for your customer in ALPHA BASIC™ without disclosing the source codes.

WESTERN DIGITAL MICROPROCESSOR

The AM-100 is based on Western Digital's advanced WD-16 microprocessor chip set. It has been re-microprogrammed to give a more flexible macro instruction set while still maintaining the general architecture and source code format on the popular PDP-11 series.

S-100 BUS COMPATIBILITY

The 16-bit processor system interfaces to the 8-bit S-100 bus by multiplexing through 70-plus TTL logic chips. This multiplexing is totally transparent to the programmer.

ALPHA BASIC COMPILER

The BASIC language processor implemented is a compiler as opposed to the more popular interpreters. It reads the source code statements and generates a compacted fully resolved object code program. The object code program is then executed by a special runtime package which is reentrant and may be shared by several users at once. The source code need not be present during execution thereby reducing memory requirements. Both random and sequential access on disk are fully supported.

IN STOCK FOR IMMEDIATE DELIVERY

- Conversion of S-100 systems start at $1495 including software and is available for immediate delivery
- Fully assembled systems with disk memory and video monitors deliverable in 30 days
- MicroAge will provide you with the best support hardware in memories, terminals and I/O systems
- Complete multi-user/multi-tasking systems available configured to your specifications and needs
- Look to MicroAge to provide you with a full consulting service for small business, scientific and educational computer systems
- User implementation is provided anywhere in the United States along with maintenance and service programs

Write or call us for further information and details.
Ask for our free 8 page brochure and price list.

MICROAGE™

803 N. Scottsdale Rd.
Tempe, Arizona 85281
Phone: (602) 894-1193
(602) 894-1129

See unit on display at our BYTE SHOP retail stores:

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Tempe, Arizona 85281
(602) 894-1129

12654 N. 28th Dr.
Phoenix, Arizona 85029
(602) 942-7300

2612 E. Broadway
Tucson, Arizona 85716
(602) 327-4579

CIRCLE INQUIRY NO. 65

bit-mapped graphic cells. Thus alphanumerics and graphics can be mixed on the same line. Mode control options include fixed graphics, switch-selectable graphics, or programmable graphics mode.

The software package contains a Graphics Driver, BASIC Links, LIFE, and demonstration programs. The Graphics Driver maps screen memory locations to H and V coordinates with subroutines to designate Black or White cells. BASIC Links provide parameter passing to permit X,Y plotting directly from BASIC. LIFE is the cell culture game using Conway's rules as described in Scientific American, Oct. 1970.

GraphicAdd comes in kit form with high-quality, plated-thru PC board, all parts including sockets and prime IC's. Fully documented hardware and software manuals (with all source listings) are included. Introductory price for the GraphicAdd Kit is $50. and it is available from most Sol dealers. For further information contact KEA Micro Design, Box 6531, Station A, Toronto, Ontario, Canada, M5W 1X4.

CIRCLE INQUIRY NO. 123

Microcomputer System for Small Business

Radio Shack has just introduced their new, low-cost TRS-80 Microcomputer System. Not a kit, the TRS-80 comes completely wired and tested, ready to plug in and use.

Possible business applications include: general ledger accounting, payroll, inventory control, accounts receivable and other clerical functions which previously required tedious, time-consuming paperwork.

Pre-recorded cassette programs will be available for many of these general, clerical functions and a comprehensive owner's manual will be supplied with the TRS-80 that will explain everything necessary for its operation from plugging it in through programming.

The TRS-80 System consists of a 53-key

professional-type keyboard and microcomputer plus regulated power supply, a computer-controlled data cassette recorder and a 12" video display monitor.

Provisions have been made in the TRS-80 for later addition of accessory, or "peripheral" items such as an additional tape recorder that would permit advanced file handling, "disc" programming, and a printer which would create a permanent, typed record of the computer output.

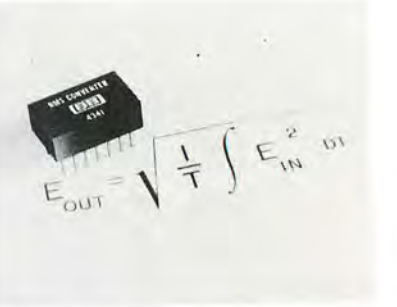
The Radio Shack TRS-80 Microcomputer System is priced at $599.95, complete with video display monitor and data cassette recorder. The microcomputer alone is available for $399.95.

For further information, contact Radio Shack, 2617 W. 7th St., Fort Worth, TX 76107, (817) 390-3272.

CIRCLE INQUIRY NO. 124

20% Price Cut for True RMS-to-DC Converter

Formerly $31.50 in single quantity, the model 4341 is now $26.00 (1-24), $20.00 (25-99) and $16.50 (100-999). At these lower prices, effective July 1, 1977, it becomes more attractive to use true RMS-to-DC converters in energy measuring equipment, analytical instruments and portable test equipment, applications previously closed to RMS converters because of high cost.



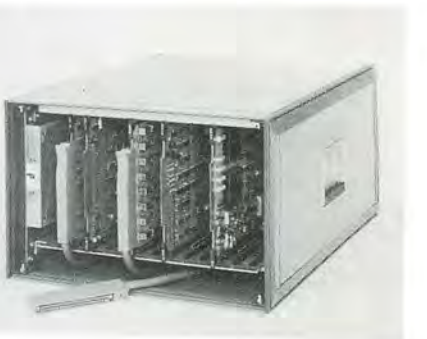
The 14-pin DIP unit has an accuracy of ± mV ± 0.2% of reading. With provisions for external adjustment of gain, offset voltage, DC reversal error and frequency response, the user can tailor the 4341 performance to his needs.

For more information, contact Dennis Haynes, Product Manager, Burr-Brown, International Airport Industrial Park, Tucson, Arizona 85734. (602) 294-1431.

CIRCLE INQUIRY NO. 125

53A ASCII Party Line System

You can now plug together automatic data acquisition and control systems without having to build hardware interfaces or write software drivers.



The cornerstone of this building block system is a mainframe which can house a family of programmable plug-in "Smart" printed circuit cards.

All the Smart cards communicate with calculators, computers and microprocessors via preformatted ASCII characters, using the decimal notations and standard formats expected by the user's application programs. The ASCII Party Line System appears to the user's system as either a high speed teletype (7000 ASCII characters per second) or an IEEE-488 bus instrument.

The various forms of Smart cards become transparent to the user's program, since all code and analog translations (ASCII to BCD, ASCII to voltage output, and etc.) are handled by the Smart printed circuit cards. This transparency allows system hardware and software to have transportability and flexibility previously unheard of.

Each mainframe can hold and power up to ten Smart cards and a maximum of ten mainframes can be connected to a single I/O port of a calculator, computer or microprocessor.

Some of the functions provided by the Smart cards are:

IEEE-488 Compatibility
Digital Data Coupling

Analog Measurement and Stimulus
Switches and Scanners
Resistance Programming
Clocks

A typical interfaced system price is between $4,000 and $9,000. Delivery eight weeks ARO. OEM discounts available. Contact: Computer Data Systems, Inc., 186-58 Homestead, Morrison, CO 80465, (303) 697-8014.

CIRCLE INQUIRY NO. 126

Microcomputer Desk

A desk specifically designed to house a personal or business microcomputer system is now available from Computer Systems Design.

The MICRODESK (copyright 1977) can be easily assembled without tools in five minutes. The desk is constructed of high-density vinyl clad board and measures 48" by 24" by 28". A sliding shelf at convenient typing height is provided for a keyboard. Also included for equipment and books are two fixed shelves, one of which is adjustable. Available as options are additional shelves or rails for rack mounted equipment.

The MICRODESK is available for $96.50, FOB Wichita, from Computer Systems Design, 1611 E. Central, Wichita, Kansas 67214.

CIRCLE INQUIRY NO. 127

Accu-Dex System

You can't tell a book by its cover — but *now* we've got a way to tell what's on a floppy—without playing it!

Once recorded you can't see what's on a floppy, unless you put it back in the computer/terminal — until NOW. We've solved the problem with an accurate, "fail-safe" indexing system that will instantly and easily give total recall of each disc's data plus the location or storage area — saves both operator time and eliminates errors.

The Accu-Dex System is designed so that each disc envelope will have a clear pressure sensitive vinyl pocket fastened to the front of it. This pocket will hold an Accu-Dex Card that will list the pertinent data relating to each disc by side and track numbers, data set name, creation and expiration dates, record length — and the identification number and location of the back-up disc. The card is clearly visible and can be easily read while still in the pocket for quick and accurate reference.

The Accu-Dex Cards are keyed to each disc by letter/number labels, the whole system is then referenced by a Master Index Card which gives a brief description of each disc and the location. If an Accu-Dex Card becomes separated from the disc envelope, it can be quickly spotted, identified by the label on the disc and correctly refiled.

The Accu-Dex System is the only "fail-safe" system that provides the user/operator with complete information — data and location — about each disc. It is a *must* for all floppy systems.

Available through local Data Processing Dealers or Office Supply, the Accu-Dex System indexes 50 discs, and retails for $14.95. For further information, contact Advance Access Group, 10526 W. Cermak, Westchester, IL 60153, (312) 562-5210.

CIRCLE INQUIRY NO. 128

Puncher

This device will exactly duplicate the punched holes on standard computer cards. Create your own, or correct mistakes. High grade solid steel, made to .001 of one inch tolerance. Instructions included, fully guaranteed. $5.50 each. Contact, PUNCH, P.O. Box 727, Stratford, CT 06497.

CIRCLE INQUIRY NO. 129

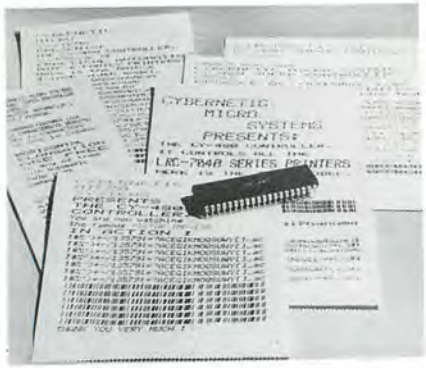
Universal Printer Controller Replaces Bulky Dedicated Controllers with One Low-Cost, 40-Pin LSI Package

The Universal Printer Controller, Model CY 480 will control and interface any standard 5"x7" dot matrix printer having a print speed up to 200 characters per second. The CY 480 works with impact, thermal and electrostatic dot matrix printers, including those from Victor, LRC, Practical Automation and Amperex.

The universal controller operates from a single +5 volt power supply and the CY 480 will interface a printer with any microcomputer or minicomputer system through standard 8-bit ports. The controller will accept either RS-232C (serial) or parallel ASCII input from the host system's data channel.

Built-in features of the CY 480 include a 5x7 dot matrix character generator, a full upper and lower case ASCII 96-character font, and a 48-character internal line buffer storage, which

is expandable to 96-characters. The Cy 480 also includes as standard an 8, 10 or 12 characters-per-inch variable character density command, a 2-color selectable print command, forward/backward printing command, and horizontal and vertical independently expanded print command.



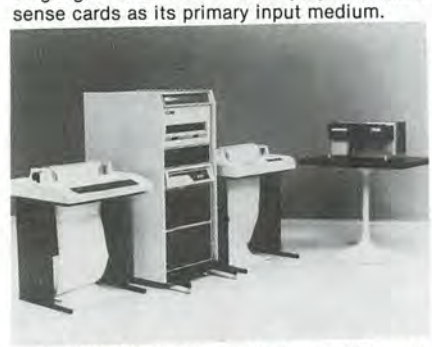
The CY480 also provides graphics capability and includes a "flip-print" operating mode to allow 180-degree viewing. Ready lines are provided for full asynchronous communications with handshaking. An optional foreign language character generator is also immediately available.

In single units (quantity 1-49), the CY 480 is priced at $92.00. In quantities of 5,000 up, the new 40-pin universal controller is $30.00. A complete price schedule and technical information, including interface specifications and pinouts, may be obtained directly from the manufacturer, Cybernetic Micro Systems, 2460 Embarcadero Way, Palo Alto, CA 94303, (415) 321-0410.

CIRCLE INQUIRY NO. 130

Batch Computer for Student Use

The MSB-11 (Mark Sense Batch-11) is a compact batch-processing system that supports both BASIC and FORTRAN IV programming languages and uses student-prepared mark sense cards as its primary input medium.



The PDP-11/04-based system, with 32K bytes of semiconductor memory and a dual floppy disc unit for program and data storage, is housed in a short (4' high) cabinet. Input/ouput devices include a 180-character-per-second line printer, LA36 DECwriter II console terminal, and a new mark sense card reader, the CMS-11K.

For further information contact Digital Equipment Corporation, Maynard, Mass. 01754, (617) 897-5111.

CIRCLE INQUIRY NO. 131

2708 Programmer

The 16 Gang Programmer is designed to program and verify PROM's of the 2708 or 2716 families. Each unit is set up to program one particular part. The Programmer will program the first tier of eight sockets while loading the second row and then programming the second row while unloading the first. A toggle switch has also been added so that all 16 sockets can be programmed at the same time.

the units all have plug in mother sockets for easy changeability when the top socket shows wear. There is a pass/fail light on each socket to easily verify the good parts and also a run and complete light so the operator knows that the unit is doing. Options are available for prober and handler interface.

The price is $2,995.00 with delivery running 30 days after receiving the order. For ordering information contact PROM Programmers, Inc., 601 Nandell Lane, Los Altos, CA 94022, (415) 948-0450.

CIRCLE INQUIRY NO. 132

New "Smart" Data Generator Offers Keyboard Entry and CRT Display in Hex, Octal, Binary & Timing Formats

A data generator, featuring a HEX keypad and scratch pad memory that directs the integral CRT display to show programming of 1024 serial bits or 64-word, 16-bit parallel channels as they are being formulated for leading into a transmit memory, is now available from Moxon Inc., Irvine, CA for testing microprocessors, IC development, computer simulation, exercising peripherals, checking data communications systems or related digital data applications.

Designated the Model 720, the self contained instrument includes all data generation, display and interface electronics in one compact unit.

In operation, the 720 can generate an algorithmic pattern which will pinpont faults in both hardware and software, thus simplifying microprocessor testing. Output data rates to 20 MHz can be generated internally or fed in from an external source. Operators are also offered a choice of one bit, one word, start-stop bits or continuous run at true positive and negative, TTL levels. In addition, microprocessor control allows options that provide interface and handshaking with other systems and controllers.

The data generator will also interface with Moxon's new low cost companion Model 741 Logic Analyzer Module. This is an ideal system combination for observing logic circuits in action. Price: $3950.00. For further information contact Moxon Inc., 2222 Michelson Dr., Irvine, CA 92715, (714) 833-2000.

CIRCLE INQUIRY NO. 133

Multiple Output DC Power Supplies

A new line of multiple output DC power supplies suitable for computer, microprocessor, instrumentation, and general industrial electronic applications has just been introduced by Standard Power, Incorporated.

Specific applications for these models, which are designaged the SPS-D and SPS-T Series, include power for memories, floppy discs, operational amplifiers, microprocessor circuitry, logic, transistorized circuitry, and similar electronic products.

The units are available in a variety of standard adjustable voltages, ranging from ± 5 Vdc to ± 28 Vdc (± 10%). Various currents are available from 1.0 to 12 amps. Standard features offered are: complete isolation between outputs, universal input 115/230 Vax, 47-440 Hz, temperature compensated circuitry, output voltage adjust, current limit, short-circuit protection, and UL recognition. A complete set of options, including over-voltage protection, are available.

A typical unit within the series is the triple output Model SPS 120T. It delivers ± 5 Vdc at 7 amps, ± Vdc at 5 amps, and ± 12 to 15 Vdc at 3.5 amps.

The general specifications are ± 0.1% for line and/or load regulation, 0.1% for ripple, 50 microsecond response time, 0.02% per degree C temperature coefficient rating, and 0 to 50 °C temperature rating.

The construction of these units is of the open-framed modular type, with built-in heat sinking for cool operating required by most O.E.M. users.

Prices range from $104 to $139, weigh from 7 to 16 pounds, and are available off-the-shelf from more than 70 electronic distributor locations throughout the United States.

For additional technical information and a copy of the new catalog, contact Standard Power, Inc., 1400 South Village Way, Santa Ana, CA 92705, (714) 558-8512.

CIRCLE INQUIRY NO. 134

6800 Real Time Application Software

Software Exchange is a newly formed company entering the field of home computer. We are developing a line of low cost software for the computer hobbyist. Our emphasis is on the practical application for the home computer.

We are now offering two telephone application programs for the 6800 microcomputer. Each program includes complete documentation, with schematic diagrams and instructions.

PROGRAM 1: 6800 Automatic Telephone Dialer . . . . . $9.95 postpaid Includes object code and punched paper tape in MIKBUG* format, and instructions for adapting to other 6800 systems.

PROGRAM 2: 6800 Telephone Answering Device . . . . . $4.95 postpaid Includes assembly listing and object code. Compatible with any 6800 system.

For further information contact Software Exchange, 2681 Peterboro, W. Bloomfield, Michigan 48033.

*MIKBUG is a registered trademark of Motorola, Inc.

CIRCLE INQUIRY NO. 135

2400 LSI Data Modem

The 2400 LSI is designed for 2400/1200 bps operation over 2- or 4-wire dedicated or dial networks. The modem employs a four-phase modulation technique conforming to CCITT Type A or B and is fully on-line compatible with the Bell system 201B or C Data Sets, most other PSK modems, as well as the Bell 801 Automatic Calling Unit. The modem features fast synchronization for use in multi-station polled networks and point-to-point applications.

The 2400 LSI is equipped with an equalizer that is strappable in either the transmit or receive sections. Strap options are provided for selecting transmitter output levels, carrier detect level, internal or external clock, carrier detector response time, RTS/CTS delays, and equalization.

When operating over the Direct-Distance-Dial Network, automatic answer circuits enable unattended all answering when connected via a Type CBS or CBT data coupler. In the Auto Answer mode an answer tone of 2025 Hz is generated for 3 seconds to switch over 801 devices or alert manual calling stations of call completion, depending upon application.

THE NEW PENRIL 2400/1200 BPS LSI DATA MODEM

Built-in local digital and analog loopback diagnostic capabilities reduce the time required to localize system malfunction.

A built-in test pattern generator and receiver pattern detector greatly simplify on and off line testing and troubleshooting. No external text equipment is required to install or troubleshoot the Penril 2400 LSI.

Basic modem functions are implemented in four MOS/LSI chips, providing reduced size and increased reliability, contained on one compact printed circuit card. The modem card measures 5 inches by 12 inches (12.5 cm by 30 cm), mounted in a free-standing enclosure. The enclosure contains an integral power supply and measures 3 inches high by 7⅜ inches wide by 12⅝ inches deep (7.5 cm by 18.5 cm by 31.6 cm). For further information and price, contact Penril Corp., 5520 Randolph Road, Rockville, Maryland 20852, (301) 881-8151.

CIRCLE INQUIRY NO. 136

"IDSWORD 1"

Interactive Data Systems has developed a word processing system, IDSWORD1, designed to run under MITS Disc Extended BASIC. Some of the more important features of the system are:

Line editing — inserting, deleting or changing text in a line of data.

Global editing — inserting, deleting, changing or finding strings of data in a selected block of text.

Merging — combining portions of various files into a single file.

Reformatting — moving words between lines for maximum line size.

Moving text — moving or copying a selected block of lines from one place to another in the text.

Printing — text is printed with optional page numbering and right justification. User specifies left margin, spacing and maximum lines per page. Top and bottom margins are set automatically.

Form letters — multiple copies of a form letter, and mailing labels, may be printed from name and address files.

IDSWORD1 is a package consisting of several programs. This fact is transparent to the user but allows it to run on a computer with 28K of memory. The user selects the mode of operation from a menu list and the control program executes the appropriate program and sets control back to select another mode.

Documentation is extensive and includes many examples and operating hints. The system is provided on a diskette.

The total price for the package is $250. For further information contact Interactive Data Systems, P.O. Box 290, Owings Mills, MD 21117, (301) 486-6945.

CIRCLE INQUIRY NO. 137

MSDV-100 Video Display System

The MSDV-100 Video Display System is a high quality 80 character, 24 line video output device for the S-100 bus. Many advanced features have been incorporated which are normally not found on units costing many times the price.

The character set includes upper and lower case characters as well as full punctuation. Any character can be underlined, a feature useful in word processing. A character can also be made to blink at a user selectable rate, often used for alarm or warning situations. Additionally, a character can be made to appear brighter than normal or to appear in a reverse field (black on white), useful in order entry or other applications to highlight text.

Internally, the MSDV-100 is a two board S-100 based system which occupies 2K of RAM address space and two Input/Output ports. Being a bus device, the microcomputer can write to the screen as fast as it can to any memory. For diagnostic purposes a memory test can be performed on the screen. For further information, contact, Micro Systems Development, 2765 So. Colorado Blvd., Suite 110, Denver, CO 80222, (303) 758-7411.

CIRCLE INQUIRY NO. 138

When you buy a microcomputer, is this your selection?

Your choice of what's on the shelf? Or, four week delivery?

At The Computer Mart, we have a full selection of hardware and peripherals. For delivery today. You can choose from all the major brands like Imsai, Polymorphic, Processor Technology, Cromenco, Apple and others. Take your pick of peripherals, terminals or monitors. Everything you need for a complete system. For personal use or for business.

We're the experienced microcomputer dealer. One of the first stores in the country. One of the largest around today. And, you know we'll still be around after you buy a microcomputer.

And, that's not all. We support what we sell with a fully staffed service department. We guide you in selecting the right combination of hardware and peripherals. And, we're there to help you with classes in software and programming. Backed by an extensive library of basic computer publications.

At The Computer Mart, we give you a choice. So, stop in or call today. And, take your pick.

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Saturday 10:00–5:30

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At The Computer Mart, we do more than just sell computers.

For professional advice before choosing your system, call The Computer Doctor.

AM-100

NOW AT

You have to SEE it to BELIEVE it!

The Alpha Microsystems AM-100 is LIGHT YEARS ahead of everything else you've seen so far in the low cost computing field.

For a FRACTION of what you'd normally pay for the SOFTWARE ALONE, you get a 16-bit processor with ALL of these BIG-SYSTEM capabilities:

MULTI-TASKING, MULTI-USER TIMESHARING

- DEVICE INDEPENDENT I/O
- ADVANCED FILE STRUCTURE
- POWERFUL SYSTEM COMMANDS
- SOPHISTICATED TEXT EDITOR
- FULL MACRO ASSEMBLER
- LINE PRINTER SPOOLER
- RE-ENTRANT, MULTI-USER BASIC *COMPILER*
- LARGE UTILITIES LIBRARY

Yet, with all this it's still compatible with the S-100 BUS!

If you like the Decsystem-10 operating system, if you like TECO . . . if you like the PDP-11 instruction set . . . you'll LOVE the AM-100!

ONLY

***$1495**

IN STOCK *NOW!*

BYTE SHOP of Pasadena

496 S. LAKE AVE.
PASADENA, CA. 91101
PHONE: (213) 684-3311

HOURS: Tuesday — Friday, 12:00 — 9:00;
Saturday & Sunday, 12:00 — 5:00;
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BOOK REVIEWS

COMPUTERS IN LABORATORY MEDICINE

Edited by Derek Enlander, M.D.
Academic Press, 1977.
200 pages, $14.00, cloth.

Review by W. Davis

This book is one of the first works that considers the future use of microprocessors in medicine. the book deals with the present use and the future potential of microprocessors in clinical laboratories. It is unfortunate that exact circuitry is not included, but the thrust of the book is not only directed at the computer buff but also at the physician. I am led to believe that the editor Dr. Enlander is preparing a volume which is technically oriented and includes circuitry. A few years ago I had the pleasure of taking a course on medical applications of computers from Dr. Enlander. The breadth of his knowledge is remarkable and this shows in his chapter on preprocessing, based on his pioneering work at Stanford University in 1968 before the advent of modern microcomputers.

The book deals with three aspects of laboratory computerization; the most commonly considered aspect is clinical pathology and fifty percent of the book deals with this topic. The fraternal specialty ANATOMIC Pathology is dealt with by two of the world's experts Pratt and Lamson. The calibre of the authors of the other chapters is equal and the publishers should be congratulated for their choice of chapter authors. George Z. Williams in the initial chapter starts the book off philosophically with references to Buckminster Fuller. Bennington considers that preprocessing data is the desired mode of approach and described the use of Hewlett-Packard desk top calculators as a means of preprocessing the data. Blois, the chairman of the relatively recently formed department of Medical Information Systems at the Unversity of California, San Francisco elegantly deals with the problems of incorporating front end systems into a hospital wide system, which in theory will take data from various departments.

The final part of the book looks at the computerization of NUCLEAR MEDICINE in which radioisotopes are introduced into the body to diagnose the presence of disease by abnormal patterns of uptake. The dynamic flow of the isotope after injection is studied in real time mode by a computer and time function curves can be produced. From these curves according to Weber diagnoses can be derived. Budinger in his chapter looks into the more exciting realm of three dimensional image reconstruction, it is remarkable that a physician even though he has a degree in engineering can define high mathematics in a manner that one can follow even if the mathematic transformation has sometimes got to be taken for granted.

The book is concisely concluded by yet another of the experts and pioneers in the field. David Seligson, the chairman of clinical pathology at Yale, describes his approach to the problem. Again like the others it is a variation on a theme. The theme is preprocessing.

The book is relatively easy to read but unfortunately difficult to come by. I obtained my copy from Seaton's, 26 O'Farrell St., San Francisco.

MICROCOMPUTER PRIMER

By Mitchell Waite and Michael Pardee
Howard Sams & Co., 1976
180 pages, $7.95, paper.

Review by Keyston Elliott

Can an old-fashioned electronic hobbyist, who has spent all his years playing with transistors, find any happiness in a 40-pin microprocessor chip? Can the walls of mystery and complexity that surround the computer ever be broken down for him? Or is he destined to quietly listen, as his friends leap into flights of fantasy, boasting of their new microcomputer projects, and looking with disdain upon his messy little two-transistor oscillator breadboard?

After about two years of this kind of experience, one has to admit that the things we hobbyists can build with today's technology has expanded beyond belief. Although I was reluctant to admit it, I could see I was rapidly missing out on a whole new world of electronic applications.

If you find yourself in a similar position, perhaps *Microcomputer Primer* might provide you with some answers.

The book is oriented toward the person with some experience in electronics and no experience in computers. An assumption is made that you understand digital logic conventions. I didn't, but I was already beginning to study several other books on TTL and CMOS logic. I was breadboarding simple CMOS logic networks, combining linear and digital circuitry to do more interesting and powerful things.

The book starts out with a perspective chapter which quickly points out what is a microcomputer, how it got here, what it is capable of doing, how hard is it to get into microcomputing, and finally just what the heck you can do with a computer.

Chapter 2 covers basic computer concepts. This was by far the best chapter, and the clearest discussion of computer operation I've seen. Buzz words like MPU, ROM, ASCII, and HEX are defined and the working parts of a computer—CPU, memory, bus, clock — are carefully and simply explained.

Chapter 3 is called Hardware. It covers an amazing range of subjects starting out with power supplies, clock circuits, and then rather suddenly launches into a discussion of construction techniques — breadboards, wire wrap guns, etc. Then the chapter returns to input/output circuitry of microcomputers — busses, tri-state gates, and interrupt processing. I think they should have put the construction techniques in the Appendix and have stuck to schematics and block diagrams in the chapter. Next there is a comparison made of ten popular microprocessors. It is rather brief, but does give one a feeling of the differences, and of what hobbyists like about them, and how we got from a 4004 to an 8080 or LSI-11. The chapter then goes into computer memory, and then explains the different ways to build computer front panels — toggle switches and LEDs, thumbwheels and 7-segment displays, HEX keyboard, and HEX software keyboard. Finally a video terminal or VDM (video display module), as the authors choose to call it, is shown. I think they could have gone further into the VDM, and shown how the ASCII keyboard works

INTERFACE AGE

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with the computer system and the video character generators, to create a character display on the CRT.

Chapter 4, called Programming, was the chapter in which I was most interested, and most reluctant to read. Still I read it and discovered that it expiained how to write a program in assembly language, the language of the microcomputer chip itself. The program example moved blocks of data from one area in memory to another, using the instruction set of the MC6800 microprocessor (Motorola). It was interesting, but I wish the authors would have included something on BASIC, as this was the programming language most of my friends were using. There is also an error in all the offset values for the branch instructions in the program.

There are two really spectacular Appendices, one on the binary number system and the other on memories. I got much out of the section on HEX math.

The appendix on memories was a journey through all the different ways to make a transistor memory cell — bipolar, static MOS, dynamic MOS, CMOS and SOS. Read Only Memory is covered, from diode PROM to dynamic ROM.

I'd say this was just the book I needed. I would have liked a chapter on BASIC, more on the differences between microprocessors, and a glossary of computer terminology. But I'm not complaining. For the electronic hardware-oriented nut like me, this book is probably the best deal around.

I/O DESIGN: DATA MANAGEMENT IN OPERATING SYSTEMS

By Donald E. Freeman and Olney R. Perry
Hayden Book Company, Inc., 1977.
374 pages, $17.50.

Review by Judy Scolney Robertson and Larry Robertson

I/O Design: Data Management in Operating Systems is a readable discussion of the I/O portion of large scale operating systems. Freeman and Perry effectively provide a clear, understandable account of how I/O systems work on large computers, notably of the IBM variety. Although it is not directed towards users of minicomputers, this book will definitely widen the perspective of the reader familiar with only small systems.

The reader, who should be somewhat familiar with assembler coding before starting *I/O Design*, will be pleased to find many useful ideas in the book. Such subject areas as channel programming, device allocation, opening and closing files, storing and retrieving data, and privacy and security are discussed in exceptional detail. The discussions of buffering in particular contain many useful and important items which are frequently forgotten; for example, the fact that the primary reason for buffering is the timing differences between I/O devices and in core processing, and that scrimping on buffering threatens to cut execution time by factors of 1000. These points are as significant to minicomputer users who are interested in increasing throughput as they are to programmers on the largest machines.

Fans of distributed processing and single user computers will probably find *I/O Design* a challenge. They may even decide to use it as a weapon in defense of their pet systems.

For an excellent discussion of the I/O portion of large scale operating systems, *I/O Design* is an exceptional choice. The person familiar with exclusively small systems will find he has broadened his viewpoint significantly after reading this book. *I/O Design: Data Management In Operating Systems* is highly recommended to anyone interested in throughput and I/O handling and usage.

By Robert A. Stevens
Software Editor

Software Section

SUMMARY OF OCTOBER SOFTWARE

This month's issue of INTERFACE AGE is chock full of software goodies that includes one business application program, one general purpose application program, three development program articles, and two game programs. A summary of this software is as follows:

- Part 2 of the **GENERAL LEDGER PACKAGE,** covering the operating procedures and example run outputs. The total software package developed by Bud Shamburger provides the small businessman with a complete and fully documented general ledger business application software package for the 8080 microcomputer system. This software package is written to run on a MITS 12K Extended Rev. 4.0 Disc BASIC interrupter. The software package includes the following BASIC Programs: Check Transactions, Ledger Transactions, Bank Statement, Journal Vouchers, Monthly and Year-to-Date Budget Analysis, Sort General Ledger Files, List General Ledger Chart of Accounts, List General Ledger Procedures and List All General Ledger Programs.
- **BIORHYTHM,** developed by William T. Mitchell, provides professional users such as physicians and psychologists with needed software for their microcomputer to chart their patients or clients in order to better determine and predict their physical, emotional, and mental states of well being.
- **ASSEMBLY LANGUAGE STRUCTURED PROGRAMMING** by Ed Keith provides an insight into writing assembly language programs using top down structured hierarchy diagrams as a road map. Although structured programming is a much needed and very powerful software development tool, it will not replace flow diagrams contrary to Ed Keith's point of view. Keep up the good work, Ed.
- **M6800 FORTRAN CROSS ASSEMBLER PROGRAM** by Gregory Trollope provides a two-pass cross assembler written in FORTRAN for use on the IBM 370 TSO (Time Share Operating System) to generate 6800 microcomputer object code.
- **SEARCH SUBROUTINE FOR THE 6502 DISASSEMBLER** by Arthur Schawlow provides a short object code search routine for use with the 6502 Disassembler program published in the 1976 September issue of INTERFACE AGE. This routine will search through an assembled program for any given instruction or any combination of characters. When and if they are found they will be displayed, jump to the disassembler and the command sought.
- **CHASE** by Joseph Jay Sanger provides a VDM controller game of CHASE written in 8080 assembly language.
- **STARS** converted to 6800 assembly language by Ed Keith provides the game of STARS on a platter for the enjoyment of the readers of INTERFACE AGE. STARS is the example program which Ed Keith uses to explain structured programming in his Assembly Language Structured Programming article in this month's issue of INTERFACE AGE.

SOFTWARE BUGS

Dr. Alan R. Miller has informed us that there is an error in the assembly listing of his HEXDUMP program that appeared in the July issue of INTERFACE AGE. The object code for ACI 40H is **CE 40** and not C3 40 as listed in line number 140 on page 156. The HEXDUMP object program dump is correct as listed on page 156.

INTERFACE AGE SOFTWARE SHOPPING LIST

Now that INTERFACE AGE has expanded the Microcomputer software coverage and developed a large appetite for good software, your programs and application software are badly needed to quench this enlarged software appetite. This software shopping list includes the following:

- Microcomputer Development Software
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- Personal Bookkeeping Programs
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- Software Communications Protocol Programs
- Off-Line Software Mass Storage Format Control Programs
- Game Programs
- Math Plotting Programs
- Statistics Programs
- Engineering Programs
- You Name It Programs

INEXPENSIVE MICROCOMPUTER SOFTWARE

The Microcomputer Software Depository (MSD) will act as repository for source and object code tapes. Programmers wishing to contribute programs to the public domain but who do not want to bother with distribution, may do so by forwarding appropriate documentation including short descriptive write-up and punch paper tape copy of program if possible or Cutts cassette or North Star Floppy Disc copy to MSD.

Anyone may obtain copies of these software packages by prepaying a small fee with the order to cover duplication, postage and handling cost. Prices will be listed in periodically in INTERFACE AGE. Typical cost for a short program will be approximately $5.00 ($3.00/ounce) plus tax, postage and handling. As a convenience MSD will also provide punched paper tape copies of vendor supplied software packages (VSP) that will be sold at vendor suggested sale prices.

For a current copy of the available software from the Microcomputer Software Depository (MSD) send a check for $1.00 with a prestamped 9" by 12" return envelope to MSD.

Support MSD to build a software library by sending copies of your documented software programs including short description, flow diagrams and punched paper tape source code and object listings if possible, or cassette tape copy for low cost distribution to the following address: Microcomputer Software Depository, 2361 E. Foothill Blvd., Pasadena, CA 91107, (213) 449-0616.

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MICROCOMPUTER SOFTWARE DEPOSITORY (MSD) PROGRAMS OCT. 1977

PROGRAM MEDIA

PTAC PAPER TAPE ASSEMBLY CODE
PTSC PAPER TAPE SOURCE CODE
PTOC PAPER TAPE OBJECT CODE
PTBC PAPER TAPE BASIC CODE
PTAL PAPER TAPE ASSEMBLY LISTING
PTSL PAPER TAPE SOURCE LISTING
PTOL PAPER TAPE OBJECT LISTING
PTOD PAPER TAPE OBJECT DUMP
PTBL PAPER TAPE BASIC LISTING
CTAL CASSETTE TAPE ASSEMBLY LISTING
CTSL CASSETTE TAPE SOURCE LISTING
CTOL CASSETTE TAPE OBJECT LISTING
CTOD CASSETTE TAPE OBJECT DUMP
CTBC CASSETTE TAPE BASIC CODE
CTBL CASSETTE TAPE BASIC LISTING
HCAC XEROX HARD COPY OF ASSEMBLY CODE
HCSC XEROX HARD COPY OF SOURCE CODE
HCOC XEROX HARD COPY OF OBJECT CODE
HCBC XEROX HARD COPY OF BASIC CODE
HCAL XEROX HARD COPY OF ASSEMBLY LISTING
HCALF FULL SIZE XEROX HARD COPY OF ASSEMBLY LISTING
HCSL XEROX HARD COPY OF SOURCE LISTING
HCOL XEROX HARD COPY OF OBJECT LISTING
HCOD XEROX HARD COPY OF OBJECT DUMP
HCBL XEROX HARD COPY OF BASIC LISTING
TEXT XEROX HARD COPY OF PRINTED TEXT
PTTL PAPER TAPE TEXT LISTING
CTTL CASSETTE TAPE TEXT LISTING
MAN MANUAL
HCGR XEROX HARD COPY OF GRAMMAR
PTGR PAPER TAPE COPY OF GRAMMAR
HBSL XEROX HARD COPY OF BINARY BOOTSTRAP LOADER
HBSL XEROX HARD COPY OF HEX BOOTSTRAP LOADER
PACK PACKAGE PRICE INCLUDES ALL ITEMS/PROGRAM # WITH SYMBOL <
FDOD FLOPPY DISC OBJECT DUMP
SUFFIX C= HAND ASSEMBLED CODE
SUFFIX L= COMPUTER FORMATED LISTING
SUFFIX D= CODE DUMP IN OCTAL OR HEX
SUFFIX F= FULL SIZE COPYY

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ASSEMBLY CODE: SAME CONTENT AS ASSEMBLY LISTING BUT HAND ASSEMBLED.

SOURCE LISTING: SOFTWARE PROGRAM LISTING RESULTING FROM COMPUTER SOFTWARE CONTROLLED ASSEMBLY PROCESS THAT INCLUDES ASSEMBLY LANGUAGE SOURCE CODED INSTRUCTIONS WITH COMMENTS. SOMETIMES, LINE STATEMENT NUMBERS ARE INCLUDED FOR EACH INSTRUCTION.

SOURCE CODE: SAME CONTENT AS SOURCE LISTING BUT HAND ASSEMBLED.

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CODE: HAND ASSEMBLED CODE (SOURCE, OBJECT, OR ASSEMBLY CODE).

LISTING: COMPUTER FORMATED LISTING.

DUMP: COMPUTER MEMORY DUMP.

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MSD PROGRAMS

CPU TYPE	SYMBOLIC NAME	DESCRIPTIVE NAME	MSD # & MEDIA	P A C K #	R E V	PRICE IN $ +CALIF. TAX(*) +USA POSTAGE(:)
6502	APPLECD	6502 APPLE COMPUTER DISASSEMBLER BY ALLEN BAUM & STEPHEN WOZNIAK-INTERFACE AGE, SEPT. 1976, VOL.1,#10.	1-TEXT 1-HCAL 1-PACK			5.00+0.30+1.00 INC. WITH TEXT
8080	LPTIIHF	LOAD 8080 PAPER TAPE IN INTEL HEX FORMAT BY BURT HASHIZUME-INTERFACE AGE, OCT. 1976, VOL.1,#11.	2-PTAL 2-PTOD 2-TEXT 2-HCAL 2-PACK	< 0 		8.00+0.48+2.00 INC. WITH PTAL 3.00+0.18+1.00 INC. WITH TEXT
8080	BFWOA	8080 BINARY FILES WITH OPTIONAL AUTOSTART BY WILLIAM H. JORDAN-INTERFACE AGE, OCT. 1976, VOL.1,#11.	3-PTAL 3-PTOD 3-TEXT 3-HCAL 3-PACK	< 0 		8.00+0.48+1.00 INC. WITH PTAL 3.00+0.18+1.00 INC. WITH TEXT
6800	MINOPS	MIN OPERATING SYSTEM BY ED KEITH & DENNIS HESCOX-INTERFACE AGE, OCT. 1976, VOL.1,#11. PTAL+ INCLUDES OPERATING INSTRUCTIONS, PAPER TAPE FORMAT AND SAMPLE RUN	4-PTAL+ 4-PTOD 4-TEXT 4-HCAL 4-PACK	< 0 		8.00+0.48+2.00 INC. WITH PTAL 2.00+0.12+1.00 INC. WITH TEXT
8080	DBBDP	DR. BEATTIE'S BASIC DIET PLANNING BY DR. BEATTIE-INTERFACE AGE, OCT. 1976, VOL.1,#11.	5-TEXT 5-HCBL 5-PTBL 5-PACK	< 0 		3.00+0.18+1.00 INC. WITH TEXT 8.00+0.48+2.00

6800	EZMERPS	ECHO 1, ZERO MEMORY, ECHO REVERSE & PRINT SUBROUTINES BY HOWARD BERENBON-INTERFACE AGE, OCT. 1976, VOL.1,#11.	6-PTAL < Ø 6-TEXT < 6-HCAL < 6-PACK ↑	5.00+0.30+1.00 1.00+0.06+1.00 INC. WITH TEXT
8080	ESP-1	ESP-1 SOFTWARE PACKAGE BY MICHAEL SHRAYER-INTERFACE AGE, OCT. 1976, VOL.1,#11. PTGR IS PAPER TAPE COPY OF GRAMMAR.	7-PTOD <Ø 7-MAN < 7-CTOD < 7-MAN < 7-PTGR < 7-HCGR < 7-PACK ↑	30.00+1.80+1.50 INC. WITH PTOD 30.00+1.80+1.50 INC. WITH CTOD 5.00+0.30+1.50 INC. WITH PTGR
8080	PTSP-1	PROCESSOR TECHNOLOGY SOFTWARE PACKAGE NO. 1 SUMMARY BY R. A. STEVENS-INTERFACE AGE, OCT. 1976, VOL.1,#11.	8-PTGR <Ø 8-TEXT < 8-PACK ↑	5.00+0.30+1.50 INC. WITH PTTL
8080	ERAMMT	EXHAUSTIVE 8080 RAM MEMORY TEST PROGRAM BY T.E.TRAVIS -INTERFACE AGE, NOV. 1976, VOL.1,#12.	9-PTAL < Ø 9-PTOD < 9-TEXT < 9-HCAL < 9-HCOD < 9-PACK ↑	6.00+0.36+2.00 INC. WITH PTAL 2.00+0.12+1.00 INC. WITH TEXT INC. WITH TEXT
6800	MEMDMP-1	SWTPC 6800 MEMORY DUMP PROGRAM MEMDMP-1 BY GARY KAY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	10-PTAL < Ø 10-PTSL < Ø 10-PTOD < 10-TEXT < 10-HCAL < 10-PACK ↑	5.00+0.30+1.00 8.00+0.48+1.00 INC. WITH PTSL 1.00+0.06+1.00 INC. WITH TEXT
6800	ROBIT-1	SWTPC 6800 ROTATING BIT RAM MEMORY DIAGNOSTIC PROGRAM ROBIT-1 BY GARY KAY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	11-PTAL < Ø 11-PTSL < Ø 11-PTOD < 11-TEXT < 11-HCAL < 11-PACK ↑	5.00+0.30+1.00 8.00+0.48+1.00 INC. WITH PTSL 1.00+0.06+1.00 INC. WITH TEXT
6800	MEMCON-1	SWTPC 6800 SHORT MEMORY ADDRESS CONVERGENCE PROGRAM MEMCON-1 BY GARY KAY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	12-PTAL < Ø 12-PTSL < Ø 12-PTOD < 12-TEXT < 12-HCAL < 12-PACK ↑	5.00+0.30+1.00 8.00+0.48+1.00 INC. WITH PTSL 1.00+0.06+1.00 INC. WITH TEXT
6800	BJIB	BLACKJACK IN BASIC PROGRAM BY ED KEITH & DENNIS HESCOX. THE BJIB PAPER TAPE OBJECT CODE REQUIRES ROBERT UITERWYK'S SWTPC MICROBASIC OPERATING SYSTEM-INTERFACE AGE, NOV. 1976, VOL.1,#12. PTBL+ INCLUDES SAMPLE RUN, INSTRUCTIONS, LIST OF VARIABLES AND LIST OF ROUTINES.	13-PTBL Ø 13-PTBL+ 13-TEXT < 13-HCBL < 13-PACK ↑	9.00+0.54+2.00 12.00+0.72+2.00 2.00+0.12+1.00 INC. WITH TEXT
6502	RFPR	REVISED FLOATING POINT ROUTINES FOR 6502* BY ROY RANKIN & STEVE WOZNIAK - INTERFACE AGE, NOV. 1976, VOL.1,#12. NOTE * - ORIGINAL MATH PACKAGE FIRST APPEARED IN DR. DOBB'S JOURNAL, AUG. 1976, VOL.1,#7.	14-PTOD < 1 14-PTAL < 14-PTSL < 14-TEXT < 14-HCAL < 14-PACK ↑	5.00+0.30+1.00 9.00+0.54+2.00 10.00+0.60+2.00 2.00+0.12+1.00 INC. WITH TEXT
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6800	DIV16	REENTRANT 16 BIT DIVIDE SUBROUTINE - DIV16 BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY- INTERFACE AGE, NOV. 1976, VOL.1,#12.	16-PTAL < 1 16-TEXT < 16-HCAL < 16-PACK ↑	8.00+0.48+1.00 1.00+0.06+1.00 INC. WITH TEXT
6800	RENTMUP	REENTRANT DOUBLE PRECISION MULTIPLICATION SUBROUTINE-RENTMUP BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	17-PTAL < Ø 17-TEXT < 17-HCAL < 17-PACK ↑	8.00+0.48+1.00 1.00+0.06+1.00 INC. WITH TEXT
8080	HOMEC	COMPUTER OR CONTROLLER BY TERRY BENSON, INTEL - INTERFACE AGE, SEPT. 1976, VOL.1,#10.	18-PTAL < Ø 18-PTSL < 18-TEXT < 18-HCAL < 18-PACK ↑	5.00+0.30+1.00 5.00+0.30+1.00 1.00+0.06+1.00 INC. WITH TEXT
8080	LCST	STARTREK BY LYNN COCHRAN-INTERFACE, JUNE 1976, VOL.1,#7.	19-PTBL < Ø 19-TEXT < 19-HCBL < 19-PACK ↑	7.00+0.42+1.00 3.00+0.18+1.00 INC. WITH TEXT
8080	WSPG	WORD SEARCH PUZZLE GENERATOR BY RICHARD S. EDELMAN - INTERFACE, JULY 1976, VOL.1,#8.	20-PTBL < Ø 20-TEXT < 20-HCBL < 20-PACK ↑	6.00+0.36+1.00 2.00+0.12+1.00 INC. WITH TEXT
8080	PGBIORHY	BIORHYTHM BY PAUL GREEN - INTERFACE AGE, AUG. 1976, VOL.1,#9.	21-PTBL < Ø 21-TEXT < 21-HCBL < 21-PACK ↑	6.00+0.36+1.00 1.00+0.12+1.00 INC. WITH PTBL
8080	WDBIORHY	BIORHYTHMS IN PRACTICE BY WILLIAM L. DONHAN, M.D. - INTERFACE AGE, AUG. 1976, VOL.1,#9.	22-PTBL < Ø 22-TEXT < 22-HCBL < 22-PACK ↑	8.00+0.48+2.00 2.00+0.12+1.00 INC. WITH TEXT
8080	REBJ	BLACKJACK BY RICHARD S. EDELMAN - INTERFACE AGE, AUG. 1976, VOL.1,#9.	23-PTBL < Ø 23-TEXT < 23-HCBL < 23-PACK ↑	6.00+0.36+1.00 1.00+0.06+1.00 INC. WITH TEXT

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8080	BLUFF	BLUFF BY PHIL FELDMAN & TOM RUGE - INTERFACE AGE, SEPT. 1976, VOL.1,#10.	24-PTBL < 0 24-TEXT < 24-HCBL < 24-PACK ↑	6.00+0.36+1.00 1.00+0.06+1.00 INC. WITH TEXT
6800	RABSIMB	RELATIVE ADDRESS BACK-STEPPER IN MICRO-BASIC BY J. HUFFMAN - INTERFACE AGE, DEC. 1976, VOL.1,#13.	25-PTBL < 0 25-HCBL < 25-TEXT < 25-PACK ↑	5.00+0.30+1.00 1.00+0.06+1.00 INC. WITH HCBL
6800	TEFT6800	TEXT EDITOR FOR THE SWTPC-6800 BY MARK BORGERSON - INTERFACE AGE, DEC. 1976, VOL.1,#13. HCAL IS COPY OF FULL SIZE ASSEMBLY LISTING.	26-PTAL < 0* 26-PTOD < 26-HCAL < 26-TEXT < 26-PACK ↑	15.00+0.90+2.00 10.00+0.60+2.00 3.00+0.18+1.50 2.00+0.12+1.25
8080	WPATBX	WANG'S PALO ALTO TINY BASIC BY ROGER RAUSKOLB - INTERFACE AGE, DEC. 1976, VOL.1,#13. HCAL & HCSL ARE COPIES OF FULL SIZE CODE	27-PTSL < 0 27-PTOD < 27-HCAL < 27-TEXT < 27-HCSL < 27-PACK ↑	20.00+1.20+3.00 10.00+0.60+2.00 4.00+0.24+1.50 INC. WITH HCAL 4.00+0.24+1.50
8080	LLLBI	LLL 8080 BASIC INTERPRETER GRAMMAR BY JERRY BARBER & ROYCE ECKARD - SUBMITTED BY E.R. FISHER - INTERFACE AGE, DEC. 1976,VOL.2,#1(PART 1). JAN. 1977,VOL.2,#2(PART 2), FEB. 1977,VOL.2,#3(PART 3), MARCH 1977,VOL.2,#4(PART 4). TEXT1 IS PART 1, TEXT2 IS PART 2, ETC. HCAL2,3, & 4 ARE FULL SIZE XEROX COPIES OF ASSEMBLY PROGRAM LISTINGS OF PARTS 2,3, & 4.	28-TEXT1< 0 28-PTSL2< 28-HCAL2< 28-TEXT2< 28-PTSL3< 28-HCAL3< 28-TEXT3< 28-PTSL4< 28-TEXT4< 28-HCAL4< 28-PACK ↑	5.00+0.30+2.00 57.00+3.42+6.00 5.00+0.30+2.00 3.00+0.18+2.00 36.00+2.16+4.00 5.00+0.30+2.00 3.00+0.18+2.00 15.00+0.90+2.00 3.00+0.18+2.00 3.00+0.18+2.00
SC/MP	NIBL	NIBL-NATIONAL'S TINY BASIC GRAMMAR FOR SC/MP BY PHIL ROYBAL - INTERFACE AGE, DEC. 1976, VOL.2, #1. ASSEMBLY LISTING PUBLISHED JAN. 1977, VOL.2,#1.	29-TEXT < 0 29-HCAL < 29-PTSL < 29-PTOD < 29-PTGR < 29-PACK ↑	5.00+0.30+2.00 10.00+3.00+2.00 10.00+3.00+2.00 5.00+0.30+1.00 2.00+0.12+1.00
SC/MP	MWBAGELS	BAGELS BY DR. MARVIN WINZINREAD BY PERMISSION & COURTESY OF NATIONAL SEMICONDUCTOR - INTERFACE AGE, DEC. 1976, VOL.2,#1.	30-PTBL < 0	5.00+0.30+2.00
8080	AMS80	AMSAT 8080 STANDARD DEBUG MONITOR BY RICHARD C ALLEN & JOE KASSER - BYTE # 13, SEPT. 1976, VOL.2,#1. SUBMITTED BY JOE KASSER.	31-PTSL < 2 31-PTOD < 31-PACK ↑	15.00+0.90+2.00 5.00+0.30+2.00
76800	BAFCMP	BASIC ALGORITHMS FOR COMMON MATH FUNCTIONS BY MICHAEL P. BURTON - INTERFACE AGE, JAN. 1977, VOL.2,#2.	32-PTBL < 1 32-TEXT < 32-PACK ↑	6.00+0.36+1.0 2.00+0.12+1.00
8080	ECMSO	MICROCOMPUTER STOCK OPTIONS	33-PTBL < 0 33-HCBLF 33-HCBLF< 33-TEXT < 33-PACK ↑	15.00+0.90+2.00 5.00+0.30+2.00 INC. WITH PTBL 5.00+0.30+2.00
		BY EDWARD CHRISTIANSON - INTERFACE AGE, FEB. 1977, VOL.2,#3.		
8080	BMRNG	RANDOM NUMBER GENERATOR BY BOB MARTIN - INTERFACE AGE, FEB. 1977, VOL.2,#3.	34-PTAL < 0 34-PTSL < 34-TEXT < 34-HCALF 34-HCALF< 34-PACK ↑	7.00+0.42+2.00 6.00+0.36+2.00 2.00+0.12+1.00 4.00+0.24+1.00 INC. WITH PTAL
8080	RNDFGCST	RND FUNCTION GENERATOR CHI-SQUARE TEST PROGRAM BY BOB MARTIN - INTERFACE AGE, FEB. 1977, VOL.2,#3.	35-PTBL < 35-HCBLF< 35-PACK ↑	4.00+0.24+1.00 INC. WITH PTBL
8080	TTMOCSR	8080 MEMORY OBJECT CODE SEARCH ROUTINE BY T. E. TRAVIS - INTERFACE AGE, FEB. 1977, VOL.2,#3.	36-PTAL < 0 36-PTSL < 36-TEXT < 36-HCALF< 36-HCALF 36-PACK ↑	5.00+0.30+1.00 5.00+0.30+1.00 1.00+0.06+1.00 INC. WITH TEXT 2.00+0.12+1.00
8080	TDOMP	8080 OCTAL MONITOR PROGRAM BY THOMAS E. DOYLE - INTERFACE AGE, FEB. 1977, VOL.2,#3.	37-PTAL < 0 37-PTSL < 37-TEXT < 37-HCALF 37-HCALF< 37-PTOD < 37-PACK ↑	8.00+0.48+2.00 8.00+0.48+2.00 2.00+0.12+1.00 4.00+0.24+1.00 INC. WITH PTAL 5.00+0.30+1.50
8080	LLLBFPMP	LLLBASIC FLOATING POINT MATH PACKAGE BY DAVID MEAD & MODIFIED BY HAL BRAND AND FRANK OLKEN - INTERFACE AGE, FEB. 1977, VOL.2,#3.	38-TEXT < 0 38-HCALF< 38-PTSL < 38-PACK ↑	3.00+0.18+2.00 5.00+0.30+2.00 36.00+2.16+4.00
8080	Z80MEBP	Z80 MITS 12K EXTENDED BASIC PATCHES BY MARTIN D. GRAY - INTERFACE AGE, MARCH 1977, VOL.2,#4.	39-TEXT < 0 39-HCALF< 39-PACK ↑	1.00+0.06+1.00 1.00+0.06+1.00
6502	RJBAST	6502 APPLE STAR-TREK BY ROBERT J. BISHOP - INTERFACE AGE, APRIL 1977, VOL.2,#5.	40-TEXT < 0 40-HCBL < 40-PACK ↑	3.00+0.18+1.00 INC. WITH TEXT
6800	AMIPROTO	AMI'S PROTO DEVELOPMENT SOFTWARE FOR EVK SERIES PROTOTYPING BOARDS BY PERMISSION AND COURTESY OF AMERICAN MICROSYSTEMS EDITED BY R.A.STEVENS-INTERFACE AGE, FEB. 1977, VOL.2,#3.	41-TEXT < 0 41-HCALF< 41-PACK ↑	3.00+0.18+1.00 5.00+0.30+2.00
8080	CONSOL	CONSOL 1K RESIDENT OPERATING SYSTEM BY PERMISSION AND COURTESY OF PROCESSOR TECHNOLOGY-INTERFACE AGE, JAN. 1977, VOL.2,#2.	42-TEXT < 0 42-HCALF< 42-PACK ↑	3.00+0.18+1.00 5.00+0.30+2.00

8080	ODT-80	LLL BASIC OCTAL DEBUGGING PROGRAM BY E. R. FISHER- INTERFACE AGE, MARCH 1977, VOL.2,#4.	43-TEXT < 0 43-HCALF 43-PACK ↑	3.00+0.18+2.00 5.00+0.30+2.00
6800	(RS)•3	RESIDENT 6800 REENTRANT SELF-RELATIVE SUBROUTINE PACKAGE FOR EVK 6800 MICROCOMPUTER BOARDS BY PERMISSION AND COURTESY OF AMERICAN MICROSYSTEMS EDITED BY R.A. STEVENS- INTERFACE AGE, MARCH 1977, VOL.2,#4.	44-TEXT < 0 44-HCALF 44-PACK ↑	3.00+0.18+1.00 5.00+0.30+2.00
6800	EXMON	6800 MIKBUG EXTENDED MONITOR SYSTEM BY MICHAEL BURTON- INTERFACE AGE, APRIL 1977, VOL.2,#5.	45-TEXT < 0 45-HCALF 45-PTAL < 45-PTOD < 45-PACK ↑	2.00+0.12+1.00 3.00+0.18+1.50 9.00+0.54+2.00 5.00+0.30+2.00
8080	LMCOS	8080 CASSETTE OPERATING SYSTEM (COS) BY LORIN MOHLER- INTERFACE AGE, APRIL 1977, VOL.2,#5.	46-TEXT < 46-PTSL < 46-HCALF< 46-PACK ↑	3.00+0.18+1.00 10.00+0.60+2.00 5.00+0.30+1.00
6800	MHFTIHFC	MOTOROLA 6800 HEX FORMAT TO INTEL FORMAT SOFTWARE CONVERTER BY FLOYD NORDIN- INTERFACE AGE, APRIL 1977, VOL.2,#5.	47-TEXT < 0 47-PTAL < 47-PTSL < 47-PTOD < 47-HCALF< 47-HCODF< 47-PACK ↑	1.00+0.06+1.00 5.00+0.30+2.00 5.00+0.30+2.00 3.00+0.18+1.00 3.00+0.18+1.00 INC. WITH HCAL
8080	MMGTEW	GRAPHICS- THE EASY WAY BY MARVIN MALLON- INTERFACE AGE, MARCH 1977, VOL.2,#4.	48-TEXT 0 48-HCBLF	3.00+0.18+1.00 5.00+0.30+1.00
8080	CBMS	BYTEMOVER SOFTWARE FOR THE CROMEMCO 8K BYTESAVER BOARD - PERMISSION AND COURTESY OF CROMEMCO EDITED BY ROGER EDELSON- INTERFACE AGE, JAN. 1977, VOL.2,#2.	49-TEXT 0 49-HCAL	5.00+0.30+1.00 INC. WITH TEXT
8080/ Z80	FNOCDA	8080/Z80 OBJECT CODE DIS-ASSEMBLER BY FLOYD L. NORDIN- STANDARD VERSION HANDLES UP TO 1K LABLES & ASSIGNS SYMBOLIC NAMES. ASCII CHARACTER LIST PIN POINTS EMBEDDED TABLES. INCLUDES BOTH ASSEMBLY AND SOURCE OUTPUT MODES VIA YOUR OUTPUT DRIVERS. PROGRAM RESIDES AT TOP OF MEMORY. STANDARD VERSIONS AVAILABLE FOR 16K, 24K, 32K, 48K AND 64K BYTES OF MEMORY. OTHER VERSIONS WITH ADDITIONAL LABLE SPACE AND/OR DIFFERENT MEMORY SIZE ARE AVAILABLE.	50-PTOD <50 50-MAN < 50-PACK ↑	40.00+2.40+2.00 5.00+0.30+1.00 45.00+2.70+3.00
6800	SWTPMB	SWTP'S 6800 MICROBASIC VER. 1.4 BY ROBERT H. UITERWYK AND BY PERMISSION & COURTESY OF SOUTHWEST TECHNICAL PRODUCTS CORP. SWTPC 6800 COMPUTER NEWSLETTER #1, JUNE 1976.	51-PTOD 0	15.00+0.90+2.00
6800	EVKMB	SWTP'S 6800 MICROBASIC VER. 1.4 MODIFIED FOR AMI'S 6800 EVK MICROCOMPUTER BOARDS BY STEVEN D. WALL.	52-PTOD 0	15.00+0.90+2.00
8080	CCOKEN	ARTIFICAL INTELLIGENCE TIC-TAC-TOE PROGRAM (OR MENACE OF THE MICROWORLD) BY KEN BERKUM -INTERFACE AGE, MARCH 1977, VOL.2,#4.	53-PTBL < 0 53-TEXT < 53-HCBL < 53-HCBL 53-PACK ↑	10.00+0.60+2.00 2.00+0.12+1.00 INC. WITH PTBL 2.00+0.12+1.00
6800	JHDOTWP	DAY OF THE WEEK PROGRAM BY JIM HUFFMAN-INTERFACE AGE, APRIL 1977, VOL.2,#5.	54-PTBL < 0 54-TEXT < 54-HCBL < 54-HCBL 54-PACK ↑	6.00+0.36+1.00 1.00+0.06+1.00 INC. WITH PTBL 1.00+0.06+1.00
6800	JHCBBP	CHECKBOOK BALANCER PROGRAM BY JIM HUFFMAN - INTERFACE AGE, APRIL 1977, VOL.2,#5.	55-PTBL < 0 55-TEXT < 55-HCBL < 55-HCBL 55-PACK ↑	6.00+0.36+1.00 1.00+0.06+1.00 INC. WITH PTBL 1.00+0.06+1.00
8080	HEXDUMP	INTEL HEX FORMAT PAPER TAPE DUMP PROGRAM BY ALAN R. MILLER - INTERFACE AGE, APRIL 1977, VOL.2,#5.	56-PTAL < 1 56-PTSL < 56-PTOD < 56-HCAL < 56-HCAL 56-HCSL < 56-HCSL 56-PACK ↑	8.00+0.48+2.00 8.00+0.48+2.00 5.00+0.30+1.00 INC. WITH PTAL 2.00+0.12+1.00 INC. WITH PTSL 2.00+0.12+1.00
8080	CONVERT1	NUMBER BASE CONVERSION- NON DISC VERSION BY JOHN W. SWAIN- INTERFACE AGE, APRIL 1977, VOL.2,#5.	57-PTBL < 0 57-TEXT < 57-HCBL < 57-HCBL 57-PACK ↑	7.00+0.42+1.00 2.00+0.12+1.00 INC. WITH PTBL 1.00+0.06+1.00
8080	CONVERT2	NUMBER BASE CONVERSION- DISC BASED VERSION OF CONVERT1 ABOVE BY JOHN W. SWAIN - INTERFACE AGE, APRIL 1977, VOL.2,#5.	58-PTBL < 0 58-TEXT < 58-HCBL < 58-HCBL 58-PACK ↑	7.00+0.42+1.00 2.00+0.12+1.00 INC. WITH PTBL 1.00+0.06+1.00
Z80	SERIAL	USER TTY HANDLER FOR THE Z80 DELEVOPMENT SYSTEM BY RICHARD E. MALY - INTERFACE AGE, APRIL 1977, VOL.2,#5.	59-TEXT 0 59-HCAL 59-PTOD < 59-PTAL < 59-PTSL < 59-PACK ↑	3.00+0.18+1.00 2.00+0.12+1.00 10.00+0.60+2.00 INC. WITH PTOD INC. WITH PTOD

6800	MEMTEST	A BETTER 6800 MEMORY TEST BY ED KEITH- INTERFACE AGE, APRIL 1977, VOL.2,#5.	60-PTAL < 0 60-PTSL < 60-PTOD < 60-TEXT < 60-HCAL < 60-HCAL 60-HCSL < 60-HCSL 60-PACK ↑	8.00+0.48+2.00 8.00+0.48+2.00 3.00+0.18+1.00 2.00+0.12+1.00 INC. WITH PTAL 2.00+0.12+1.00 INC. WITH PTSL 2.00+0.12+1.00
8080	AMLIFE	JOHN CONWAY'S GAME OF LIFE PROGRAMMED BY ALAN R. MILLER -INTERFACE AGE, APRIL 1977, VOL.2,#5.	61-PTAL < 4 61-PTSL < 61-PTOD < 61-TEXT < 61-HCAL < 61-HCAL 61-HCSL < 61-HCSL 61-PACK ↑	15.00+0.90+2.00 10.00+0.60+2.00 5.00+0.30+1.00 2.00+0.12+1.00 INC. WITH PTAL 2.00+0.12+1.00 INC. WITH PTSL 2.00+0.12+1.00
8080	SFSL	STAR LANES PROGRAM BY STEVEN FABER - INTERFACE AGE, APRIL 1977, VOL.2,#5.	62-PTBL < 0 62-HCBL < 62-TEXT < 62-HCBL < 62-HCBL 62-PACK ↑	15.00+0.60+2.00 2.00+0.12+1.00 2.00+0.12+1.00 INC. WITH PTBL 2.00+0.12+1.00
6800	HDSS	SHOOTING STARS TBX PROGRAM BY HERMAN DEMONSTOY - INTERFACE AGE, JUNE 1977, VOL.2,#7.	63-PTBL < 0 63-HCBL < 63-TEXT <	10.00+0.60+2.00 2.00+0.12+1.00 2.00+0.12+1.00
8080	PAYROLL	PAYROLL PROGRAM IN BASIC BY BUD SHAMBURGER - INTERFACE AGE, JUNE 1977, VOL.2,#7.	64-PTBL < 0 64-HCBL < 64-TEXT < 64-PACK ↑	250.00+TAX +5.00
8080	TCOS	D&M'S TAPE CASSETTE SOFTWARE OPERATING SYSTEM FOR THE 8080 MICROCOMPUTER -SUMMARY BY R.A. STEVENS - INCLUDES 8080 ASSEMBLER + LINE TEXT EDITOR + MONITOR - TAPE FORMAT IS DON TARBELL'S OR PROCESSOR TECHNOLOGY'S CUTS STANDARD. INTERFACE AGE, JULY 1977, VOL.2,#8.	65-CTOD < 0 65-MAN <	30.00+1.80+2.00 5.00+0.30+1.00
8080	PTOS	D&M'S PAPER TAPE SOFTWARE OPERATING SYSTEM FOR THE 8080 MICROCOMPUTER-SUMMARY BY R.A. STEVENS -SAME AS TCOS #65-CTXX BUT FOR ASR 33 TTY I/O SYSTEM- INTERFACE AGE, JULY 1977, VOL.2,#8.	66-PTOD < 0 66-MAN <	30.00+1.80+2.00 5.00+0.30+1.00
8080	DOSF	D&M'S DISC SOFTWARE OPERATING SYSTEM EXTENSION FOR THE NORTH STAR 8080 FLOPPY DISC OPERATING SYSTEM - SUMMARY BY R.A. STEVENS - ADDS TCOS/PTOS FUNCTIONS TO PROVIDE FULL OPERATING SYSTEM CAPABILITIES TO THE LIMITED NORTH STAR FLOPPY DISC SOFTWARE OPERATING SYSTEM. PROGRAM MEDIA IS A NORTH STAR FLOPPY DISC.- INTERFACE AGE, JULY 1977, VOL.2,#8.	67-FDOD < 0 67-MAN <	60.00+3.60+3.00 5.00+0.30+1.00
SC/MP	SSEIKOPP	SC/MP SEIKO PRINTER INTERFACE AND PROGRAM BY PHILIP ROYBAL - INTERFACE AGE, MAY 1977, VOL.2,#6.	68-PTSL < 0 68-PTOD < 68-HCSL < 68-HCOD < 68-TEXT < 68-PACK ↑	15.00+0.90+2.00
Z80	RASST	Z80 SUPER STAR TREK MODIFIED BY ROGER AMIDON. RUNS ON TDL'S Z80 8K BASIC	69-PTBL < 0 69-HCBL < 69-PACK ↑	10.00+0.60+2.00 2.00+0.12+1.00
8080	DODR	DIABLO OUTPUT DRIVER ROUTINE BY CHRIS TARRY - INTERFACE AGE, JULY 1977, VOL.2,#8.	70-PTOD < 0 70-PTSL < 70-PTAL < 70-TEXT < 70-PACK ↑	15.00+0.90+2.00
6800	IOTST	6800 PIA I/O TEST PROGRAM BY WILLIAM C. WRARY OF MOTOROLA & PERMISSION AND COURTESY OF MOTOROLA'S 6800 USER GROUP LIBRARY - INTERFACE AGE, JULY 1977, VOL.2,#8.	71-PTOD < 0 71-PTSL < 71-TEXT < 71-HCOD < 71-HCSL < 71-PACK ↑	7.00+0.42+1.50 10.00+0.60+2.00 INC. WITH PTSL 2.00+0.12+1.00 3.00+0.18+1.00
8080	TICTAC	TIC TAC TOE GAME IN BASIC BY BUD SHAMBURGER - INTERFACE AGE, JULY 1977, VOL.2,#8.	72-PTBL	7.00+0.42+2.00
8080	BOWL	BOWL GAME IN BASIC BY BUD SHAMBURGER - INTERFACE AGE, JULY 1977, VOL.2,#8.	73-PTBL	7.00+0.42+2.00
6800	BILOAD	HIGH DENSITY TAPE LOAD BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY - INTERFACE AGE, AUG. 1977,VOL.2,#9.	74-PTSL < 0 74-HCSL < 74-HCSL 74-TEXT < 74-PACK ↑	8.00+0.48+1.00 INC. WITH PTSL 2.00+0.12+1.00 1.00+0.06+1.00
6800	BIPUNCH	HIGH DENSITY BINARY TAPE PUNCH BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY- INTERFACE AGE, AUG. 1977, VOL.2,#9.	75-PTSL < 0 75-HCSL < 75-HCSL 75-TEXT < 75-PACK ↑	8.00+0.48+1.00 INC. WITH PTSL 2.00+0.12+1.00 1.00+0.06+1.00
	LMT	LOCAL MEAN TIME BY JAMES J. BRENNAN - INTERFACE AGE, AUG. 1977, VOL.2#9.	76-PTBL < 0 76-HCBL < 76-TEXT < 76-PACK ↑	3.00+0.18+1.00 INC. WITH PTBL 1.00+0.06+1.00
	ASTRON	LOCAL SIDEREAL TIME & DATE	77-PTBL < 0	10.00+0.60+1.00

		BY JAMES J. BRENNAN - INTERFACE AGE, AUG. 1977, VOL.2,#9.	77-HCAL <	INC. WITH PTBL
			77-TEXT <	2.00+0.12+1.00
			77-HCBL	2.00+0.12+1.00
			77-PACK ↑	
6800	MKBSORT	BUBBLE SORT BY MARTIN KNIGHT - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	78-PTOD < 0	3.00+0.18+1.00
			78-HCOD <	INC. WITH PTOD
			78-HCAL <	"
			78-TEXT <	1.00+0.06+1.00
			78-PACK ↑	4.00+0.24+2.00
6800	LTBPT	LOAD TRANSPARENT BINARY PAPER TAPE BY JACK D. JOHNSON- INTERFACE AGE, SEPT. 1977, VOL.2,#10.	79-PTOD < 0	3.00+0.18+1.00
			79-PTSL <	6.00+0.36+1.50
			79-PTAL <	7.00+0.42+1.50
			79-HCOD <	1.00+0.06+1.00
			79-HCSL <	1.00+0.06+1.00
			79-HCAL <	1.00+0.06+1.00
			79-TEXT <	2.00+0.12+1.00
			79-PACK ↑	
6800	PTBPT	PUNCH TRANSPARENT BINARY PAPER TAPE BY JACK D. JOHNSON - INTERFACE AGE, SEPT. 1977,VOL.2,#10.	80-PTOD < 0	3.00+0.18+1.00
			80-PTSL <	6.00+0.36+1.50
			80-PTAL <	7.00+0.42+1.50
			80-HCOD <	1.00+0.06+1.00
			80-HCSL <	1.00+0.06+1.00
			80-HCAL <	1.00+0.06+1.00
			80-TEXT <	2.00+0.12+1.00
			80-PACK ↑	
6800	JHDSAP	DEPRECIATION SCHEDULE ANALYSIS PROGRAM BY JIM HUFFMAN - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	81-PTBL < 0	5.00+0.30+1.00
			81-HCBL <	2.00+0.12+1.00
			81-TEXT <	2.00+0.12+1.00
			81-PACK ↑	
8080	JHDSAP	DEPRECIATION SCHEDULE ANALYSIS PROGRAM BY JIM HUFFMAN - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	82-PTBL < 0	5.00+0.30+1.00
			82-HCBL <	2.00+0.12+1.00
			82-TEXT <	2.00+0.12+1.00
			82-PACK ↑	
8080	PERSCII0	8080/Z80 I/O DRIVER PROGRAM FOR THE PERSCI 1070 INTELLIGENT DISKETTE BY MICHAEL D. BUSCH -INTERFACE AGE, SEPT. 1977, VOL.2,#10.	83-PTOD < 0	3.00+0.18+1.00
			83-PTSL <	5.00+0.30+1.00
			83-HCAL <	2.00+0.12+1.00
			83-TEXT <	2.00+0.12+1.00
			83-PACK ↑	
8080	BSGLP	GENERAL LEDGER PACKAGE BY BUD SHAMBURGER - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	84-PTBL < 0	
			84-HCBL <	
			84-TEXT <	
			84-PACK ↑	
8080	GLTSCOS	TIMESHARE COMPUTER OPERATING SYSTEM BY JEB LONG - INTERFACE AGE, SEPT. 1977, VOL.2,#10.	85-PTOD < 0	10.00+0.60+2.00
			85-PTSL <	20.00+1.20+3.00
			85-HCOD <	2.00+0.12+1.00
			85-HCSL <	4.00+0.24+1.00
			85-PACK ↑	
6800	STARS	STARS BY ED KEITH-INTERFACE AGE, OCT. 1977, VOL.2,#11.	86-PTOD < 0	5.00+0.30+2.00
			86-PTSL <	10.00+0.60+3.00
			86-HCOD <	1.00+0.06+1.00
			86-PACK ↑	
8080	JSVCHASE	VIDEO CHASE FOR 8080/VDM BY JOSEPH JAY SANGER-INTERFACE AGE, OCT. 1977, VOL.2,#11.	87-PTOD < 0	10.00+0.60+2.00
			87-PTSL <	15.00+0.90+3.00
			87-HCOD <	3.00+0.18+1.00
			87-HCSL <	3.00+0.18+1.00
			87-HCAL <	5.00+0.30+1.00
			87-TEXT <	3.00+0.18+1.00
			87-PACK ↑	
	WMBIORHY	BIORYTHM BY W. MITCHELL - INTERFACE AGE, OCT. 1977, VOL.2,#11.	89-PTBL < 0	
			89-HCBL <	
			89-TEXT <	
			89-PACK ↑	

"Now, about this Debugging Kit you sent me . . ."

Biorhythm

By William T. Mitchell

One of the more visible changes which have taken place in our society over the past few years, is that an increasing number of people are taking an interest in subjects which they would have dismissed as superstitious folly only a short time ago. Transcendental Meditation is now widely practiced, and appears to be becoming more common by the day. Astrology was once almost universally regarded as pure hokum: now nearly everyone knows the sign of the Zodiac under which they were born and an increasing number of persons seem to take seriously the "influence" of the stars.

Biorhythms are another area which has seen increasing interest. One company has recently marketed a pocket calculator which will tell you the status of your Biorhythm Cycle on any given day. This article describes a BASIC program to plot anyone's Biorhythm Chart for any given time period. The chart produced is 64 columns wide, and can be displayed on a 64x16 CRT monitor if no hardcopy device is available.

The Biorhythm theory postulates that there are certain metabolic cycles, known as *inner clocks,* which have a constant period in the human body. The three main cycles are a 23-day *Physical Cycle,* a 28-day *Emotional Cycle* and a 33-day *Intellectual Cycle.* The Physical cycle is associated with physical vitality, endurance and energy level. The Emotional cycle corresponds to sensitivity, intuition and cheerfulness. The Intellectual cycle is related to mental alertness, cognitive power and judgement ability. All three cycles start at zero on the upswing at the moment of birth and continue unbroken throughout a person's lifetime.*

According to Biorhythm Theory, the high periods of a cycle are the times when a person will probably have the most energy, be most cheerful, mentally sharp, outgoing and alert. The low periods can be regarded as recuperative times, when the body is recharging its batteries. The days on which any cycle crosses the *Zero* line are called *Critical Days,* and performance may be unstable on these days.

The Biorhythm program presented in this article generally flows from top to bottom. It is divided into several distinct sections, each doing a specific job and each headed by a descriptive remark. In most cases I find it natural to program in this format. I try to stay with this format even at the cost of extra effort because it makes programs relatively easy to read and understand when I want to modify them after six months of not looking at them.

**The tenuousness of the theory hinges upon this postulated starting point. There is no "moment of birth," merely a series of steps in an ongoing process of development. The day of birth is a legal or civic rather than biological event. —ed.*

The 100 series statements initialize the program. Arrays are dimensioned, the string array T$ is loaded with the names of the days of the week, the 12-element array F is loaded with the number of days in each month and the constant K is set to 2*PI.

The 200-series statements obtain input data for the program. It is important to note here that the program requires input of the date in an unusual format, requiring the full four digit year instead of the more usual last two digits. I have found that in situations such as this it is usually a mistake to expect people to read and follow instructions, so it is best to anticipate bad input data and provide error messages and recovery where possible. In this case, if only the last two digits of the year are entered the program will correct the year to a 20th Century date and print the corrected date. I only checked the year because I felt that this was the only input parameter where unintentional error was really likely, and I wanted to conserve program space.

According to Biorhythm Theory the high periods of the cycle are times when a person's potential for cheerfulness, acuity and alertness is optimum.

The 300-series statements calculate the number of days which have elapsed between the birthdate supplied and the start of the Biorhythm chart. Leap years are taken into account and extra days are added as required. Also, since the algorithm used to calculate the day of the week is only valid for dates since September 14, 1752 (when the Gregorian calendar was introduced) P1 and P2 are reset to 8 to print a blank for the weekday name opposite dates prior to this. If you will be modifying this program or rewriting it for a different version of BASIC, this section is the most likely source of errors. When I checked an early version of this program against two Biorhythm plotters available on a local timesharing service I found that all three gave different charts. Checking further into this, I found that all three charts were wrong. I fixed the problems with my program and notified the systems managers of the timesharing service of the problems. Figure 2 is part of a typical test run, showing some of the checks which must be made to verify that the program operates properly.

The 400-series statements print the chart header and set F(2) to 29 if we're beginning plotting a leap year.

```
                    BIORYTHM CHART FOR BILL MITCHELL

                              BORN ON   TUE  3/ 2/ 1943
                              BEGINNING SUN  5/ 1/ 1977

                              P=PHYSICAL      (23 DAYS)
                              E=EMOTIONAL     (28 DAYS)
                              I=INTELLECTUAL  (33 DAYS)
                              A=OVERALL AVERAGE

                    DOWN                  CRITICAL                    UP
                    ----------------------!----------------------
SUN    5/ 1                    I          !        A      E        P
MON    5/ 2                  I            !        A E             P
TUE    5/ 3                    I          !      E A               P
WED    5/ 4                               E       A          P
THU    5/ 5                    E          !     A            P
FRI    5/ 6                  E            !   A      IP
SAT    5/ 7              E                A  P           I
SUN    5/ 8          E                  PA !                 I
MON    5/ 9       E              P      A  !                    I
TUE    5/ 10   E          P           A    !                       I
WED    5/ 11  E     P               A     !                        I
THU    5/ 12   E                    A     !                         I
FRI    5/ 13  P E                   A     !                         I
SAT    5/ 14   P    E               A     !                        I
SUN    5/ 15      P      E            A   !                     I
MON    5/ 16           P       E        A !                  I
TUE    5/ 17                 P       E    A!                I
WED    5/ 18                       P       E A         I
THU    5/ 19                               P   A EI
FRI    5/ 20                               ! I    A   E
SAT    5/ 21                             I !        A   P  E
SUN    5/ 22                         I     !          A       P E
MON    5/ 23                     I         !           A          PE
TUE    5/ 24                 I             !           A            E
WED    5/ 25             I                 !          A              E
THU    5/ 26          I                    !         A               E
FRI    5/ 27    I                          !      A                P  E
SAT    5/ 28  I                            !    A             P    E
SUN    5/ 29  I                            A          P      E
MON    5/ 30    I                        A  !  P        E
TUE    5/ 31      I                  A   P  !      E
```

Figure 1. This is a typical biorhythm chart showing the interrelationship between the Physical, Emotional and *Intellectual* cycles.

The 500-series statements do the actual work of generating the chart. If the version of BASIC you are using does not include a SIN function, the Series 900 subroutine can be used with the modification discussed being made in Lines 535 through 580. Of course, using the Series 900 subroutine to generate the SIN function will cause the program to run much more slowly than if a BASIC SIN function is used. The actual body of the Biorhythm chart is printed in the string array O$. If access to individual characters in a string is not available, the string O$ could be eliminated and the characters to be printed sorted by position and printed with tabs.

The PRINT#4 statements in Sections 400 and 500 cause my system to print the Biorhythm Chart on a hardcopy printer. If your system has no hardcopy printer, changing these statements to simple PRINT statements should cause the chart to be displayed on the terminal's CRT monitor.

The 600-series statements increment the day, month and year counters. F(2) is reset to 28 or 29 as required for leap years.

The 700-series subroutine sets pointer P2 according to the day of the week corresponding to the date in M2, D2 and Y2.

The 800-series subroutine calculates the number of days expended in prior months of the current year.

The 900-series subroutine allows the calculation required by Lines 535, 550 and 565 of the program to be performed on systems running versions of BASIC which lack the SIN function. In order to use this subroutine, Lines 535 and 540 should be replaced with the following statements:

```
535 X = 23
536 GOSUB 900
540 O$[X*25 + 26] = "P"
```

Lines 550 through 580 should also be rewritten, calling the subroutine with X set to 28 and 33 and making the required adjustment in the pointers into the string O$.

Since completing this program, I've plotted Biorhythm Charts for most of my friends. I find that I'm watching my own chart for any correlation between my charted Biorhythms on any day and how that day actually turned out. If my experience is anything to go by, the Biorhythm plotter on your system will be one of your more often used programs.

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```
                    BIORYTHM CHART FOR NO LEAP YRS

                              BORN ON   SAT  2/ 27/ 1965
                              BEGINNING SUN  2/ 27/ 1966

                              P=PHYSICAL      (23 DAYS)
                              E=EMOTIONAL     (28 DAYS)
                              I=INTELLECTUAL  (33 DAYS)
                              A=OVERALL AVERAGE

                DOWN                    CRITICAL                    UP
                ----------------------!----------------------
SUN    2/ 27          P                A!     E  I
MON    2/ 28               P            !   A      E  I
TUE    3/ 1                     P       !        A      EI
WED    3/ 2                             P            A      E
THU    3/ 3                             !      P         A     E

                  BIORYTHM CHART FOR BEGINNING LEAP YR

                              BORN ON   THU  2/ 27/ 1964
                              BEGINNING SAT  2/ 27/ 1965

                              P=PHYSICAL      (23 DAYS)
                              E=EMOTIONAL     (28 DAYS)
                              I=INTELLECTUAL  (33 DAYS)
                              A=OVERALL AVERAGE

                DOWN                    CRITICAL                    UP
                ----------------------!----------------------
SAT    2/ 27               P            !   A      E  I
SUN    2/ 28                    P       !        A      EI
MON    3/ 1                             P            A      E
TUE    3/ 2                             !      P         A     E
WED    3/ 3                             !           P       A  E

                 BIORYTHM CHART FOR ENDING LEAP YR

                              BORN ON   SAT  2/ 27/ 1963
                              BEGINNING THU  2/ 27/ 1964

                              P=PHYSICAL      (23 DAYS)
                              E=EMOTIONAL     (28 DAYS)
                              I=INTELLECTUAL  (33 DAYS)
                              A=OVERALL AVERAGE

                DOWN                    CRITICAL                    UP
                ----------------------!----------------------
THU    2/ 27          P                A!     E  I
FRI    2/ 28               P            !   A      E  I
SAT    2/ 29                    P       !        A      EI
SUN    3/ 1                             P            A      E
MON    3/ 2                             !      P         A     E
TUE    3/ 3                             !           P       A  E
```

Figure 2. This is the result of some test runs to determine that the Leap Years are being handled correctly. These tests show that the Physical cycle crosses the Zero Line 369 days after birth whether or not a Leap Year is involved.

LISTING 1 This is a listing of the Biorhythm Plotting Program

```
 10  REM BIORHYTHM PLOTTING PROGRAM
120  DIM F[12],J[2
130  READ T$[1],T$[2],T$[3],T$[4],T$[5],T$[6],T$[7],T$[8]
140  DATA "SUN","MON","TUE","WED","THU","FRI","SAT","     "
150  READ K,F[1],F[2],F[3],F[4],F[5],F[6],F[7],F[8],F[9],F[10],F[11],F[12]
160  DATA 6.283185,31,28,31,30,31,30,31,31,30,31,30,31
200  RAM DATA INPUT SECTION
210  INPUT Z$
215  PRINT "ENTER DATES IN THE FORMAT MM,DD,YYYY"
220  PRINT "EXAMPLE — JUNE 16, 1944 WOULD BE 6,16,1944"
225  PRINT
230  PRINT TAB 11;"BIRTHDATE: ";
235  INPUT M1,D1,Y1
240  IF Y1>99 THEN 255
245  Y1 = Y1 + 1900
250  PRINT TAB 25,Y1
255  M2 = M1,D2 = D1,Y2 = Y1
260  GOSUB 700
265  P1 = P2
270  PRINT "START DATE FOR CHART: ";
275  INPUT M2,D2,Y2
280  IF Y2>99 THEN 295
285  Y2 = Y2 + 1900
290  PRINT TAB 25,Y2
295  GOSUB 700
297  PRINT "LENGTH OF CHART IN DAYS: ";
298  INPUT L
300  REM CALCULATE OFFSET, TAKING LEAP YEARS INTO ACCOUNT
305  X = M1
310  GOSUB 800
315  J1 = J2 + Y1*365
320  IF J1<639723 THEN P1 = 8
325  X = M2
330  GOSUB 800
335  J2 = J2 + Y2*365
340  IF J2<639723 THEN P2 = 8
345  O = J2 – J1 + 4*INT((Y2 – Y1)/4 – INT((Y2 – Y1)/4))
350  IF Y1/4 – INT(Y1/4)<>0 THEN 400
355  IF Y2>Y1 THEN 370
360  IF M2>2 THEN 370
365  GOTO 400
370  IF M1<3 THEN O = O + 1
400  REM PRINT CHART HEADER
405  FOR I = 1 TO 5
410  PRINT#4,
415  NEXT I
420  PRINT#4,TAB 20;"BIORHYTHM CHART FOR ";Z$
425  PRINT#4,
430  PRINT#4,TAB 28;"BORN ON    ";T$[P1];"  ";M1;"/";D1;"/";Y1
435  PRINT#4,TAB 28;"BEGINNING ";T$[P2];"  ";M2;"/";D2;"/";Y2
440  PRINT#4,
445  PRINT#4,TAB 28,"P = PHYSICAL          (23 DAYS)"
450  PRINT#4,TAB 28,"E = EMOTIONAL         (28 DAYS)"
455  PRINT#4,TAB 28,"I = INTELLECTUAL      (33 DAYS)"
```

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```
460 PRINT#4,TAB 28,"A = OVERALL AVERAGE"
465 PRINT#4,
470 PRINT#4,TAB 13,"DOWN";TAB 34;"CRITICAL";TAB 62;"UP"
475 PRINT#4,TAB 13;"----------!----------"
480 REM SET F[2] TO 29 FOR LEAP YEARS
485 IF Y2/4 – INT(Y2/4) = 0 THEN F[2] = 29
500 REM GENERATE THE BIORHYTHM PLOT
505 L = O + L
510 C = 0
515 FOR O = O TO L – 1
520 C = C + 1
525 O$ = "                    !
530 Y = 0
535 X = (SIN(K*(O/23 – INT(O/23)))*25) + 26
540 O$[X] = "P"
545 Y = Y + X
550 X = (SIN(K*(O/33 – INT(O/33)))*25) + 26
555 O$[X] = "I"
560 Y = Y + X
565 X = (SIN(K*(O/28 – INT(O/28)))*25) + 26
570 O$[X] = "E"
575 Y = (Y + X)/3
580 O$[Y] = "A"
585 PRINT#4,T$[P2];TAB 5;M2;"/";D2;TAB 13;O$
600 REM INCREMENT DATE
605 IF P2 = 8 THEN 680
610 P2 = P2 + 1
615 IF P2>7 THEN P2 = 1
620 D2 = D2 + 1
625 IF D2>F[M2] THEN D2 = 1,M2 = M2 + 1
630 IF M2<13 THEN 640
635 M2 = 1,Y2 = Y2 + 1
640 IF Y2/4 – INT(Y2/4)<>0 THEN 655
645 F[2] = 29
650 GOTO 660
655 F[2] = 28
660 NEXT O
670 STOP
700 REM FIND DAY OF WEEK
705 N1 = M2 + 12*INT(.6 + 1/M2)
710 N2 = Y2 – INT(.6 + 1/M2)
715 N3 = INT(13*(N1 + 1)/5)
720 N4 = INT(5*N2/4)
725 N5 = INT(N2/100)
730 N6 = INT(N2/400)
735 N7 = N3 + N4 – N5 + N6 + D2 – 1
740 RETURN
800 REM FIND DAYS EXPENDED IN PRIOR MONTHS
810 J2 = 0
820 FOR I = 1 TO X – 1
830 J2 = J2 + F[I]
840 NEXT I
850 RETURN
```

LISTING 2 This is a listing of the optional 900-series subroutine which is used on systems having no SIN function.

```
905 X = K*(O/X – INT(O/X))
910 X2 = X 2,X3 = X,N1 = 1,N2 = 2,N3 = 1
915 X4 = X
920 FOR N5 = N2 TO N2 + 1
925 N3 = N3*N5
930 NEXT N5
935 N2 = N5
940 X3 = X3*X2,N1 = – 1*N1
945 X = X + N1*X3/N3
950 IF X<>X4 THEN 915
955 RETURN
```

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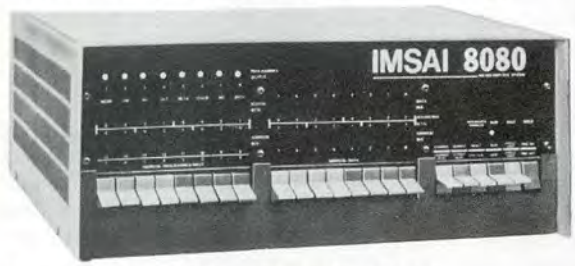

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SEARCH SUBROUTINE FOR THE 6502 DISASSEMBLER*

by Arthur L. Schawlow

The following is a description, listing and sample run of an object code search subroutine for use with the 6502 Disassembler published in your September 1976 issue. —author

This subroutine can search an assembled program for any combination of characters. It then jumps to the disassembler and displays the command sought. To use it, store the starting address of the program to be examined at 0044. Then at 0050 store the number of bytes to be sought and the bytes themselves.

For example, the November 1976 Apple BASIC used the BACKUP key (HEX code DF) to erase, but the Datanetics ASR-33 keyboard has no BACK UP key. However, it does have a RUB OUT key (HEX code FF). Thus, we wish to find where the long BASIC program checks to see if a character is a DF. That is, we want to find CMP #$DF or in HEX code C9 DF.

We enter	44: 00 E0	(ret)
and	50: 02 C9 DF	(ret)
Then	7C8R	

(7C8 is the starting address of the subroutine.) The 02 is the number of bytes being sought.

Almost instantly, the computer displays

E286—	C9 DF	CMP #$DF
E288—	F0 11	BEQ $E29B
	etc.	

Enter R (ret), and the computer displays

E4BA—	C9 DF	CMP #$DF
E4BC—	F0 06	BEQ $E4C4
	etc.	

Thus if we change E287 and E4BB to FF, we are able to use the RUB OUT key to erase a character in a BASIC instruction.

PROGRAM LISTING

```
09F0:   20
07C8-     A0 00     LDY   #$00
07CA-     A2 00     LDX   #$00
07CC-     B1 44     LDA   ($44-,Y
07CE-     D5 51     CMP   $51,X
07D0-     F0 0D     BEQ   $07DF
07D2-     E6 44     INC   $44
07D4-     A9 00     LDA   #$00
07D6-     C5 44     CMP   $44
07D8-     D0 02     BNE   $07DC
07DA-     E6 45     INC   $45
07DC-     4C CC 07  JMP   $07CC
07DF-     E8        INX
07E0-     E4 50     CPX   $50
07E2-     F0 14     BEQ   $07F8
07E4-     C8        INY
07E5-     B1 44     LDA   ($44-,Y
07E7-     D5 51     CMP   $51,X
07E9-     F0 F4     BEQ   $07DF
07EB-     E6 44     INC   $44
07ED-     A9 00     LDA   #$00
07EF-     C5 44     CMP   $44
07F1-     D0 02     BNE   $07F5
07F3-     E6 45     INC   $45
07F5-     4C C8 07  JMP   $07C8
07F8-     4C F0 09  JMP   $09F0
```

SAMPLE RUN

```
44:00     E0

0044:     F8
50:02     C9 DF

0050:     00
7C8R

07C8:     A0
E286-       C9 DF     CMP   #$DF
E288-       F0 11     BEQ   $E29B
R
E4BA-       C9 DF     CMP   #$DF
E4BC-       F0 06     BEQ   $E4C4
```

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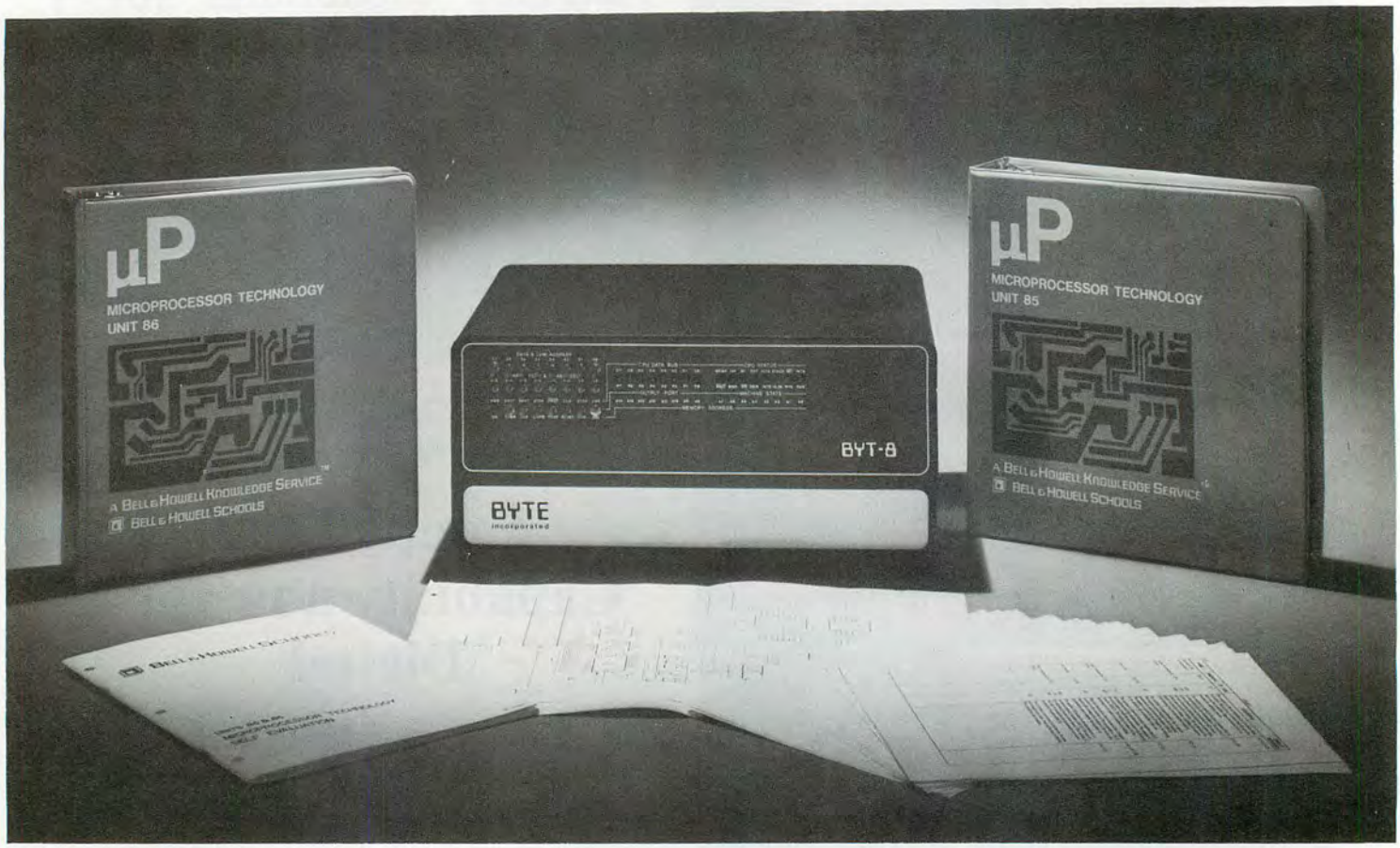

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M6800 FORTRAN CROSS ASSEMBLER PROGRAM

by Gregory A.R. Trollope

The author's 6800 Cross-Assembler Program is written in FORTRAN IV, and while he uses it on an IBM 370 TSO system, it should be readily adaptable to any FORTRAN processor. The output is in Motorola paper tape format.

His system consists of an SWTPC 6800, and a Lear Siegler "dumb terminal" with an acoustic coupler which he attaches to the MODEM socket on the terminal; the micro is attached to the 'extension' socket. With his configuration it is possible to transfer the object code directly from TSO to the micro, under MIKBUG control. The example included in this article is a routine to transfer object code from the micro back to TSO.

—Software Editor

ABSTRACT

A two-pass cross-assembler is described for the 6800 microprocessor. Input is in fixed format; statements are similar to Motorola Assembler Language, most features of this language being supported. Additionally, a System Symbol Table is supported, enabling contiguous core locations. Some interfacing problems with TSO are described.

INTRODUCTION

Some preliminary investigations of the design of an Assembler for Motorola Assembler language indicated that the source code is fairly difficult to assemble, necessitating a quite complex FORTRAN program. The main reasons for this are that the rules for determining the length of an instruction (in bytes) are quite complicated, and in some cases, imprecise. Also, it is difficult to decide exactly what should be placed in the bytes subsequent to the first.

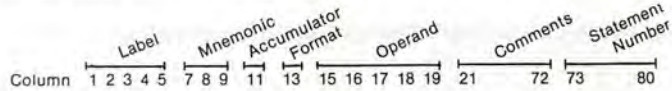
To obviate these problems, it was decided to introduce a new field to the instruction, which instructs the Assembler the length of the instruction and the contents of the operand bytes. This has been designated the 'Format' field, and simply informs the Assembler whether the instruction is Direct, Extended, Relative, etc., see below.

A further simplification of the Assembler was to require a fixed format input. This is not too burdensome using the Tab setting feature of the Edit modes of TSO — tabs should be at the Mnemonic, Format and Comments fields start. This has a real advantage in that a simple list of the program can be understood readily.

The object code produced by the program is in Motorola paper tape format, in absolute form, so that the program is loaded to location to which it is assembled. To obtain some of the advantages of a relocating loader, the concept of a System Symbol Table was introduced to permit symbolic references to important system locations, without the necessity to define these within the program. Thus, for example, the ACIA registers may be referred to symbolically, so that if a revision of the hardware moves the ACIA location, it will be necessary only to update the system symbol table, and reassemble all relevant routines. Also, the address of the byte after the last byte in the previous routine assembled is saved in the System Symbol Table. In the absence of an initial ORG statement, the Assembler uses this address as the address of the first byte of the source code. By a two-pass assembly of a complete system, module by module, most of the advantages of a relocating assembler are obtained.

ASSEMBLER INSTRUCTION FORMAT

This assembler is designed to work with instructions in a fixed format, see below:



LABEL

If the character in Column 1 is A, the line will be treated as a comment. Otherwise, the label field may be blank, or consist of 1-5 characters, left justified in the field. The first must be alphabetic A to Z, or the character @. In the latter case, the address of the label will be entered (or updated) in the system symbol table, for use by subsequent assemblies.

MNEMONIC

The mnemonic codes are identical to those of Motorola for instructions. The assembler directives recognized are as follows:

NAM	Column 15 thru 72 will be printed at the top of each page
LIS	Comment listing — the default in the absence of NOL
NOL	Cease listing
RMB	Reserve a block of memory of length equal to the operand
FCB	Form one byte constant — one only
FDB	Form a two byte constant — one only
EQU	Equate the label to the operand
ORG	Define the origin of an assembly. In the absence of an initial ORG statement, the assembler will use the next available address after the end of the previous assembly. This address is saved in the System Symbol Table.
END	End of source program

ACCUMULATOR

The accumulator field must be A or B, to refer to the respective accumulators, or blank.

FORMAT

The format field indicates the instruction type as follows:

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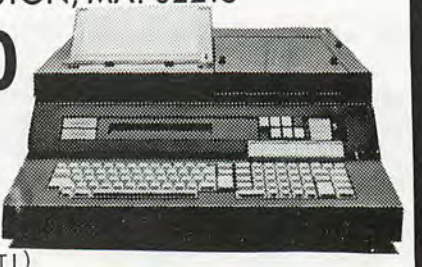

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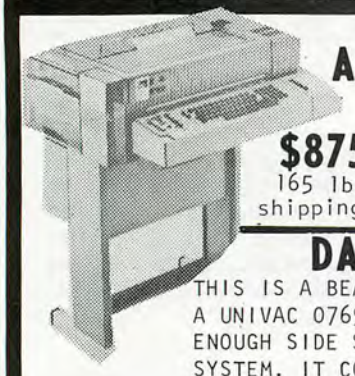

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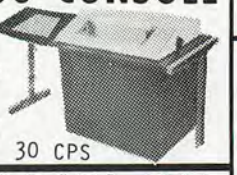

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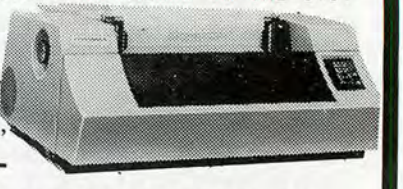

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I Immediate — LDS, LDX or CPX

blnk Accumulator or inherent

R Relative

A Assembler Directive

OPERAND

The operand consists of one of the following:

a) A label, including system symbol table references;

b) The character $ followed by 0 to 4 hexadecimal characters to indicate a hexadecimal number;

c) 1 to 5 decimal digits, to indicate a decimal number;

d) The character ' followed by a printable ASCII character, to indicate the character value;

e) blank, to indicate 0.

COMMENTS

The comments field will be reproduced without modification.

STATEMENT NUMBER

The statement number is used for editing purposes only; the last five characters are listed at the beginning of the source listing.

ERROR MESSAGES

The following error codes may be printed, followed by the line in error,

- Assembler error: the label address computed in Pass 2 does not agree with that computed in Pass 1
- Undefined assembler directive
- EQU operand undefined
- Op-code undefined
- Invalid or undefined operand
- Operand value too large for one byte
- Duplicate label

FORWARD REFERENCES

The two-pass nature of the assembler restricts the symbolic references to a single level of forward reference, see the Motorola programming manual. References to the system symbol table are considered to be forward references, as the table is loaded at the end of Pass 1.

THE OBJECT CODE

The object code generated is standard Motorola paper tape format (Applications Manual, page 5-60). The end-of-file record (S9) is not punched, as its presence is usually a disadvantage when loading the micro directly from TSO.

USE ON TSO

The source program is read from the dataset allocated to file FT01001, the object code written to file FT02F001; the system symbol table should be allocated to file FT03F001.

A useful convention of dataset naming is to name the source code:

EXAMPLE.DATA

the object code:

EXAMPLE.OBJECT DATA

the system symbol table:

SYSTEM DATA

Then the CLIST below can be used to invoke the assembler with the command:

EX (ASSEM) 'EXAMPLE'

```
CLIST(ASSEM)
00010  PROC 1 DA
00020  ALLOC DA(&DA..DATA) F(FT01F001)
00030  ALLOC DA(&DA..0BJ.DATA) F(FT02F001)
00040  ALLOC DA(SYS.DATA) F(FT03F001)
00050  LOAD ASSEM
```

```
00260     2     FØRMAT(80A1)
00270     C
00280     C     IS FIRST CHAR *?
00290           IF(LINE(1).EQ.AST)GØ TØ 1
00300     C
00310     C     IS FIRST CHAR BLANK?
00320           IF(LINE(1).EQ.BL)GØ TØ 25
00330     C
00340     C     LABEL..ENTER INTØ SYMBØL TABLE
00350     20    DØ 21 J=1,5
00360     21    LABEL(J,LABP)=LINE(J)
00370     C
00380     C     EQU?
00390           IF(LINE(8).NE.Q)GØ TØ 23
00400           ASSIGN 22 TØ IGØ
00410           GØ TØ 100
00420     22    VALUE(LABP)=VAL
00430           GØ TØ 24
00440     C
00450     23    VALUE(LABP)=CØUNT
00460     C
00470     24    LABP=LABP+1
00480     C
00490     C     EXTENDED ADDR?
00500     25    IF(LINE(13).NE.E)GØ TØ 3
00510     5     CØUNT=CØUNT+3
00520           GØ TØ 1
00530     C
00540     C     IMPLIED?
00550     3     IF(LINE(13).NE.BL) GØ TØ 4
00560           CØUNT=CØUNT+1
00570           GØ TØ 1
00580     C
00590     C     INDEX IMMED?
00600     4     IF(LINE(13).EQ.I)GØ TØ 5
00610     C
00620     C     ASSEMBLER DIRECTIVE?
00630           IF(LINE(13).EQ.A)GØ TØ 6
00640     C     ALL ØTHERS=2 BYTES
00650           CØUNT=CØUNT+2
00660           GØ TØ 1
00670     C
00680     C     ASSEMBLER DIRECTIVES
00690     C     RMB?
00700     6     IF(LINE(8).NE.M)GØ TØ 8
00710           ASSIGN 7 TØ IGØ
00720           GØ TØ 100
00730     7     CØUNT=CØUNT+VAL
00740           GØ TØ 1
00750     C
00760     C     ØRG?
00770     8     IF(LINE(8).NE.R) GØ TØ 10
00780           ASSIGN 9 TØ IGØ
00790           GØ TØ 100
00800     9     CØUNT=VAL
00810           GØ TØ 1
00820     C
00830     C     FCB?
00840     10    IF(LINE(8).NE.CC)GØ TØ 11
00850           CØUNT=CØUNT+1
00860           GØ TØ 1
00870     C
00880     C     FDB?
00890     11    IF(LINE(8).NE.D)GØ TØ 12
00900           CØUNT=CØUNT+2
00910           GØ TØ 1
00920     C
00930     C     END?
00940     12    IF(LINE(8).NE.N)GØ TØ 1
00950     C
00960     C
00970     C     PASS 2
00980     C
00990     C     LØØK THRØUGH SYSTEM SYMBØL TABLE
01000     29    K=LABP-1
01010     15    READ(3,13,END=19)CØUNT,IN
01020           DØ 16 J=1,K
01030           DØ 17 JK=1,5
01040           IF(IN(JK).NE.LABEL(JK,J))GØ TØ 16
01050     17    CØNTINUE
01060           GØ TØ 15
01070     16    CØNTINUE
01080     C
01090           VALUE(LABP)=CØUNT
01100           DØ 18 JK=1,5
01110     18    LABEL(JK,LABP)=IN(JK)
01120           LABP=LABP+1
01130           GØ TØ 15
01140     C
01150     19    REWIND 1
01160           REWIND 3
01170           LIST=1
01180           CØUNT=CSAV
01190           DØNE=0
01200           LAB=1
01210           NEXT=7
01220           NEX=7
01230           CHECK=0
01240     C
01250     C     EMIT HEADER
01260           WRITE(2,28)
01270     28    FØRMAT('S00600004844521B')
01280     C
01290     C     CLEAR BUFFER
01300     30    DØ 31 J=1,12
01310     31    BUF(J)=BL
01320     C
01330     C     READ A LINE
01340           READ(1,2,END=90)LINE
01350           ERR=0
01360     C
01370     C     IS FIRST CHAR *?
01380           IF(LINE(1).NE.AST)GØ TØ 33
01390     32    IF(LIST.EQ.0)GØ TØ 30
01400     325   CALL LINS(NAME,1)
01410           WRITE(6,34)(LINE(J),J=76,80),BUF,(LINE(
01420     34    FØRMAT(5A1,1X,12A1,1X,72A1)
01430           IF(DØNE.EQ.0)GØ TØ 30
01440           GØ TØ 90
01450     C
01460     C     LABEL?
01470     33    IF(LINE(1).EQ.BL)GØ TØ 339
01480     C
01490     C     CHECK FØR DUPLICATE
01500           K=LAB-1
01510           IF(K.EQ.0)GØ TØ 343
01520           DØ 341 J=1,K
01530           DØ 342 K2=1,5
01540           IF(LINE(K2).NE.LABEL(K2,J))GØ TØ 341
01550     342   CØNTINUE
01560           ERR=7
01570           GØ TØ 343
01580     341   CØNTINUE
01590     C
01600     C     EQU?
01610     343   IF(LINE(8).NE.Q)GØ TØ 335
01620           ASSIGN 331 TØ IGØ
01630           GØ TØ 100
01640     331   IF(VAL.NE.-1)GØ TØ 333
01650           ERR=3
01660           GØ TØ 338
01670     333   IF(VALUE(LAB).EQ.-1)GØ TØ 332
01680           IF(VAL.NE.VALUE(LAB))ERR=1
01690     332   VALUE(LAB)=VAL
01700           DØ 345 J=1,4
01710           DIGIT=VAL-VAL/16*16
01720           BUF(10-J)=TABLE(DIGIT+1)
01730     345   VAL=VAL/16
01740     338   LAB=LAB+1
01750           GØ TØ 70
01760     C
01770     C     NØRMAL INSTRUCTIØN
01780     335   IF(VALUE(LAB).NE.CØUNT)ERR=1
01790           VALUE(LAB)=CØUNT
01800           LAB=LAB+1
01810     C
01820     C     ASSEMBLER DIRECTIVE?
01830     339   IF(LINE(13).NE.A)GØ TØ 60
01840     C
01850     C     LIST?
01860           IF(LINE(8).NE.I)GØ TØ 35
01870           LIST=1
01880           GØ TØ 54
01890     C
01900     C     NØLIST?
01910     35    IF(LINE(8).NE.Ø)GØ TØ 36
01920           LIST=0
01930           GØ TØ 30
01940     C
01950     C     END
01960     36    IF(LINE(8).NE.N)GØ TØ 365
01970           ASSIGN 362 TØ KGØ
01980           GØ TØ 223
01990     362   ASSIGN 80 TØ IGØ
02000           GØ TØ 220
02010     C
02020     C     ALL ØTHER DIRECTIVES HAVE ARG..GØ GET
02030     365   ASSIGN 37 TØ IGØ
02040           GØ TØ 100
02050     C
02060     C     RMB?
02070     37    IF(LINE(8).NE.M)GØ TØ 39
02080     372   ASSIGN 375 TØ KGØ
02090           GØ TØ 223
02100     375   ASSIGN 38 TØ IGØ
02110           GØ TØ 219
02120     38    CØUNT=CØUNT+VAL
02130           GØ TØ 32
02140     C
02150     C     ØRG?
02160     39    IF(LINE(8).NE.R)GØ TØ 40
02170           ASSIGN 395 TØ KGØ
02180           GØ TØ 223
02190     395   CØUNT=VAL
02200           ASSIGN 32 TØ IGØ
02210           GØ TØ 219
02220     C
02230     C     FCB?
02240     40    IF(LINE(8).NE.CC)GØ TØ 42
02250           K=VAL-VAL/256*256
02260           ASSIGN 41 TØ IGØ
02270           GØ TØ 210
02280     41    CØUNT=CØUNT+1
02290           GØ TØ 32
02300     C
02310     C     FDB?
02320     42    IF(LINE(8).NE.D)GØ TØ 52
02330           ASSIGN 43 TØ IGØ
02340           K2=VAL
02350           GØ TØ 200
02360     43    CØUNT=CØUNT+2
02370           GØ TØ 32
02380     C
02390     C     NAME?
02400     52    IF(LINE(8).NE.A)GØ TØ 48
02410           DØ 53 J=1,5Ø
02420     53    NAME(J)=LINE(J+14)
02430     54    IF(LIST.NE.0)CALL FØRM(NAME)
02440           GØ TØ 30
02450     C
02460     C
02470     C     ERRØRS
02480     C ! ASSEMBLER ERRØR
02490     49    J=1
02500     51    CALL LINS(NAME,1)
02510           WRITE(6,47)J
02520     47    FØRMAT('ERRØR',I5)
02530           GØ TØ 325
02540     C
02550     C     ERRØR 2 INVALID ASSEMBLER DIR
02560     48    J=2
02570           GØ TØ 51
02580     C     ERRØR 3 EQU ARG UNDEFINED
02590     50    J=3
02600           GØ TØ 51
02610     C
02620     C
02630     C     INSTHUCTIØN
02640     60    IN(1)=LINE(7)
02650           IN(2)=LINE(8)
02660           IN(3)=LINE(9)
02670           IN(4)=LINE(11)
02680           IN(5)=LINE(13)
02690           DØ 62 K=1,256
02700           DØ 61 J=1,5
02710           IF(IN(J).NE.INS(J,K))GØ TØ 62
02720     61    CØNTINUE
02730           GØ TØ 63
02740     62    CØNTINUE
02750     C     ERRØR 4.ØP CØDE UNDEFINED
02760           ERR=4
02770           K=3
02780     C
02790     C     K IS INSTRUCTIØN CØDE
02800     63    K=K-1
02810     C
02820     C     FIND INSTRUCTIØN TYPE
02830     C     ØNE ØYTE?
02840           IF(LINE(13).NE.BL)GØ TØ 666
02850           ASSIGN 65 TØ IGØ
02860           GØ TØ 210
02870     65    CØUNT=CØUNT+1
02880     70    IF(ERR.EQ.0)GØ TØ 32
02890           J=ERR
02900           GØ TØ 51
02910     C
02920     C     ALL ØTHERS NEED ARG..GØ GET
02930     666   IF(ERR.NE.0)GØ TØ 67
02940           ASSIGN 66 TØ IGØ
02950           GØ TØ 100
02960     66    IF(VAL.GE.0)GØ TØ 68
02970     C     ERRØR 5..INVALID ARG TØ VALID INS
02980           ERR=5
02990     67    VAL=0
03000     C
03010     C     EXT, ØR LDX LDS IMMEDIATE
03020     68    IF(LINE(13).NE.I .AND. LINE(13).NE.E)GØ TØ 71
03030           K2=VAL
03040           ASSIGN 69 TØ IGØ
03050           GØ TØ 207
03060     69    CØUNT=CØUNT+3
03070           GØ TØ 70
03080     C
03090     C     DUMP SYMBØL TABLE
03100     90    LABP=LABP-1
03110           IF (LIST.EQ.0)GØ TØ 92
03120           CALL LINS(NAME,LABP/5+3)
03130           WRITE(6,91)((LABEL(J,JK),J=1,5),VALUE(JK)),JK=1,LABP)
03140     91    FØRMAT(//'SYMBØL TABLE',/5(5A1,1X,Z4,5X))
03150     C
```

```
03160       C     WRITE LAST ADDRESS
03170       92    WRITE(3,13)COUNT
03180       C
03190       C     DUMP SYSTEM SYMBOL TABLE
03200             DO 95 J=1,LABP
03210       95    IF(LABEL(1,J).EQ.AT)WRITE(3,13)VALUE(J),(LABEL(JK,J),JK=1,5
03220       C
03230       C     WRITE EPILOG
03240       C     WRITE(2,94)
03250       94    FORMAT('$XQ30000FC')
03260             IF (LIST.NE.0)CALL FORM(NAME)
03270             CALL EXIT
03280       C
03290       C     RELATIVE INS WITH LABEL
03300       71    IF(LINE(13).NE.R.OR.LINE(15).EQ.DO)GO TO 72
03310             VAL=VAL-COUNT-2
03315             IF(VAL.LT.-128)GO TO 721
03316             IF(VAL.GT.127)GO TO 721
03320             IF(VAL.LT.0)VAL=VAL+256
03330       C
03340       C     FILL SECOND BYTE OF 2 BYTE INDS
03350       C     ERROR 6...ARG TOO LARGE FOR ONE BYTE
03360       72    IF(VAL.GE. 0  .AND.  VAL.LE.255)GO TO 725
03370       721   ERR=6
03380             VAL=VAL-VAL/256*256
03390       725   ASSIGN 73 TO IGO
03400             K2=VAL
03410             GO TO 205
03420       73    COUNT=COUNT+2
03430             GO TO 70
03440       C
03450       80    DONE=1
03460             GO TO 32
03470       C
03480       C     AFTER END ST
03490       C
03500       C
03510       C     SUBROUTINE TO EVALUATE SYMBOL
03520       100   VAL=0
03530       C
03540       C     BLANK?
03550             IF(LINE(15).EQ.BL)GO TO 102
03560       C
03570       C     HEX?....$
03580             IF(LINE(15).NE.D0)GO TO 110
03590             DO 101 J=16,19
03600             DO 103 KJ=1,16
03610             IF(TABLE(KJ).EQ.LINE(J))GO TO 93
03620       103   CONTINUE
03630       C     NON-HEX CHAR TERMINATES FIELD
03640             GO TO 102
03650       93    VAL=VAL*16+KJ-1
03660       101   CONTINUE
03670       C
03680       102   GO TO IGO,(22,7,9,37,66,331)
03690       C
03700       C     CHARACTER VAL?
03710       110   IF(LINE(15).NE.APOS)GO TO 105
03720             DO 115 VAL=1,64
03730             IF(LINE(16).EQ.T(VAL))GO TO 116
03740       115   CONTINUE
03750             VAL=1
03760       116   VAL=VAL+31
03770             GO TO 102
03780       C
03790       C     DECIMAL?
03800       105   DO 122 J=15,19
03810             DO 123 KJ=1,10
03820             IF(TABLE(KJ).EQ.LINE(J))GO TO 124
03830       123   CONTINUE
03840             IF(J.EQ.15)GO TO 130
03850             GO TO 102
03860       124   VAL=VAL*10+KJ-1
03870       122   CONTINUE
03880             GO TO 102
03890       C
03900       C     LOOK UP IN SYMBOL TABLE
03910       130   VAL=-1
03920             KJ=0
03930       111   KJ=KJ+1
03940             IF(KJ.EQ.LABP)GO TO 102
03950             DO 112 J=1,5
03960             IF(LABEL(J,KJ).NE.LINE(J+14))GO TO 111
03970       112   CONTINUE
03980       C
03990       C     FOUND
04000             VAL=KJ
04010             VAL=VALUE(VAL)
04020             GO TO 102
04030       C
04040       C
04050       C     BUFFER FILLING SUBROUTINE
04060       C     2 BYTES ONLY
04070       200   CHECK=CHECK+K2-K2/256*255
04080             DO 201 J=1,4
04090             DIGIT=K2-K2/16*16
04100             BUF(10-J)=TABLE(DIGIT+1)
04110             PUNCH(NEXT+4-J)=TABLE(DIGIT+1)
04120       201   K2=K2/16
04130             NEX=NEXT
04140             NEXT=NEXT+4
04150             GO TO 220
04160       C
04170       C     SECOND OF TWO
04180       205   CHECK=CHECK+K2
04190             DO 206 J=1,2
04200             DIGIT=K2-K2/16*16
04210             BUF(11-J)=TABLE(DIGIT+1)
04220             PUNCH(NEXT+4-J)=TABLE(DIGIT+1)
04230       206   K2=K2/16
04240             NEX=NEXT
04250             NEXT=NEXT+4
04260              GO TO 209
04270       C
04280       C     2+3 OF THREE
04290       207   CHECK=CHECK+K2-K2/256*255
04300             DO 208 J=1,4
04310             DIGIT=K2-K2/16*16
04320             BUF(13-J)=TABLE(DIGIT+1)
04330             PUNCH(NEXT+6-J)=TABLE(DIGIT+1)
04340       208   K2=K2/16
04350             NEX=NEXT
04360             NEXT=NEXT+6
04370             GO TO 209
04380       C
04390       C     FIRST
04400       210   NEX=NEXT
04410             NEXT=NEXT+2
04420       209   CHECK=CHECK+K
04430             DO 211 J=1,2
04440             DIGIT=K-K/16*16
04450             BUF(3-J)=TABLE(DIGIT+1)
04460             PUNCH(NEX+2-J)=TABLE(DIGIT+1)
04470       211   K=K/16
04480       C
04490       C     ADDRESS
04510       220   IF(NEX.EQ.7.AND..NOT.(LINE(8).EQ.R .AND. LINE(13).EQ.A))
04515             $             CHECK=CHECK+COUNT-COUNT/256*255
04517       219   C=COUNT
04520             DO 221 J=1,4
04530             DIGIT=C-C/16*16
04540             BUF(5-J)=TABLE(DIGIT+1)
04550             IF(NEX.EQ.7)PUNCH(7-J)=TABLE(DIGIT+1)
04560       221   C=C/16
04570             IF(NEXT.LT.30)GO TO 222

04580             ASSIGN 222 TO KGO
04590       C
04600       C     COMPUTE CHECKSUM
04610       223   IF(NEXT.EQ.7)GO TO 231
04620             CHECK=CHECK+NEXT/2
04630             CHECK=255-CHECK+CHECK/256*256
04640             DO 225 J=1,2
04650             DIGIT=CHECK-CHECK/16*16
04660             PUNCH(NEXT+2-J)=TABLE(DIGIT+1)
04670       225   CHECK=CHECK/16
04680       C
04690             CHECK=0
04700             NEX=NEXT/2
04710             DO 230 J=1,2
04720             DIGIT=NEX-NEX/16*16
04730             PUNCH(3-J)=TABLE(DIGIT+1)
04740       230   NEX=NEX/16
04750             NEXT=NEXT+1
04760             WRITE(2,22v)(PUNCH(J),J=1,NEXT)
04770             NEXT=7
04780             NEX=NEXT
04790       22v   FORMAT('$I',70A1)
04800       231   GO TO KGO,(222,375,395,362)
04810       222   GO TO IGO,(36,32,41,65,43,69,73,60)
04820             END
04830             SUBROUTINE FORM(NAME)
04840             INTEGER*2 NAME(58), K/0/,SKIP(30)/0,2000C,28*0/,PAGE/1/
04850             K=55
04860       2     WRITE(6,1)SKIP,NAME,PAGE
04870       1     FORMAT(30A2/5X,58A1,' PAGE',I3//)
04880             PAGE=PAGE+1
04890       3     RETURN
04900             ENTRY LINS(NAME,L)
04910             K=K-L
04920             IF(K.GT.0)GO TO 3
04930             K=55-L
04940             GO TO 2
04950             END
04960             BLOCK DATA
04970             IMPLICIT INTEGER*2(A-Z)
04980             COMMON /INS/INS(5,256)
04990             DIMENSION P1(135),P2(135),P3(135),P4(135),P5(135),
05000            $P6(135),P7(135),P8(135),P9(135),PA(65)
05010             EQUIVALENCE(INS(1),P1),(INS(136),P2),(INS(271),P3),
05020            $(INS(406),P4),(INS(541),P5),(INS(676),P6),(INS(811),P7),
05030            $(INS(946),P8),(INS(1081),P9),(INS(1216),PA)
05040             DATA P1/
05050            $ 'E',2R',2R',0D',0D',  'E',2R',2N',0D',1D',  'E',2R',2R',0D',2D',
05060            $ 'E',2R',2R',0D',3D',  'E',2R',2R',0D',4D',  'E',2R',2R',0D',5D',
05070            $ 1D',2A',2R',' ',' ',  1D',2R',2A',' ',' ',  'E',2N',2X',' ',' ',
05080            $ 2D',2E',2X',' ',' ',  2C',2L',2V',' ',' ',  2S',2E',2V',' ',' ',
05090            $ 2C',2L',2C',' ',' ',  2S',2E',2C',' ',' ',  2C',2L',1C',' ',' ',
05100            $ 2S',2B',1C',' ',' ',  2S',2B',2A',' ',' ',  2C',2B',2A',' ',' ',
05110            $ 'E',2R',2R',1C',2C',  'E',2R',2R',1C',3C',  'E',2R',2R',1C',4C',
05120            $ 'E',2R',2R',1C',5C',  1D',2A',2B',' ',' ',  1D',2B',2A',' ',' ',
05130            $ 'E',2R',2R',1C',8C',  0D',2A',2A',' ',' ',  'E',2R',2R',1C',9A'/
05140             DATA P2/
05150            $ 2A',2B',2A',' ',' ',  'E',2R',2R',1C',2C',  'E',2R',2R',1C',2D',
05160            $ 'E',2R',2R',1C',2E',  'E',2R',2R',1C',2F',  'B',2R',2A',' ',2R',
05170            $ 'E',2R',2R',2C',1C',  2R',2H',1C',' ',2R',  'B',2L',2S',' ',2R',
05180            $ 'B',2C',2C',' ',2R',  'B',2C',2S',' ',2R',  'B',2N',2E',' ',2R',
05190            $ 'B',2E',2Q',' ',2R',  'B',2V',2C',' ',2R',  'B',2V',2S',' ',2R',
05200            $ 'B',2P',2L',' ',2R',  'B',2M',1C',' ',2R',  'B',2G',2E',' ',2R',
05210            $ 'B',2L',2T',' ',2R',  'B',2G',1C',' ',2R',  'B',2L',2E',' ',2R',
05220            $ 1T',2S',2X',' ',' ',  1C',2N',2S',' ',' ',  2P',2U',2L',2A',' ',
05230            $ 2P',2U',2L',2B',' ',  0D',2E',2S',' ',' ',  1T',2X',2S',' ',' '/
05240             DATA P3/
05250            $ 2P',2S',2H',2A',' ',  2P',2S',2H',2B',' ',  'E',2R',2R',2C',2B',
05260            $ 2R',1T',2S',' ',' ',  'E',2R',2R',2C',2A',  2R',1C',1C',' ',' ',
05270            $ 'E',2R',2R',2C',2C',  'E',2R',2H',2C',2D',  'N',2A',1C',' ',' ',
05280            $ 2S',2W',1C',' ',' ',  'N',2E',2G',2A',' ',  'E',2R',2R',2A',1C',
05290            $ 'E',2R',2R',2A',2C',  2C',2D',2W',2A',' ',  'L',2S',2R',2A',' ',
05300            $ 'E',2R',2R',2A',5A',  2R',2D',2R',2A',' ',  2A',2S',2R',2A',' ',
05310            $ 2A',2S',2L',2A',' ',  2R',2D',2L',2A',' ',  0D',2E',2C',2A',' ',
05320            $ 'E',2R',2R',2A',8A',  1C',2N',2C',2A',' ',  1T',2S',1T',2A',' ',
05330            $ 'E',2R',2R',2A',2E',  2C',2L',2R',2A',' ',  'N',2E',2G',2B',' '/
05340             DATA P4/
05350            $ 'E',2R',2R',2S',2D',  'E',2R',2R',2S',2E',  2C',2D',2W',2B',' ',
05360            $ 'L',2S',2R',2B',1C',  'E',2R',2R',2S',2F',  2R',2D',2R',2B',1C',
05370            $ 2A',2S',2R',2B',1C',  2A',2S',2L',2B',1C',  2R',2D',2L',2B',1C',
05380            $ 0D',2E',2C',2B',1C',  'E',2R',2N',2S',2B',  1T',2N',2C',2B',1C',
05390            $ 1T',2S',2T',2B',1C',  'E',2R',2N',2S',2E',  2C',2L',2R',2B',1C',
05400            $ 'N',2E',2G',1C',2X',  'E',2R',2N',2D',1C',  'E',2R',2R',2B',2D',
05410            $ 2C',2W',2W',1C',2X',  'L',2S',2R',1C',2X',  'E',2R',2R',2B',5D',
05420            $ 2R',2W',2R',1C',2X',  2A',2S',2R',1C',2X',  2A',2S',2L',1C',2X',
05430            $ 2R',2W',2L',1C',2X',  0D',2E',2C',1C',2X',  'E',2R',2R',2B',8B'/
05440             DATA P5/
05450            $ 1T',2N',2C',1C',2X',  1T',2S',2L',1C',2X',  1J',2W',2P',1C',2X',
05460            $ 2C',2L',2W',1C',2X',  2N',2E',2G',1C',2E',  'E',2R',2R',2T',1C',
05470            $ 'E',2R',2R',2T',2D',  2C',2D',2W',1C',2E',  'L',2S',2R',1C',2E',
05480            $ 'E',2R',2R',2T',5D',  2R',2D',2R',1C',2E',  2A',2S',2R',1C',2E',
05490            $ 2A',2S',2L',1C',2E',  2R',2D',2L',1C',2E',  0D',2E',2C',1C',2E',
05500            $ 'E',2R',2W',2T',8D',  1T',2N',2C',1C',2E',  1T',2S',2T',1C',2E',
05510            $ 2C',2W',2P',1C',2E',  2C',2L',2W',1C',2E',  2S',2U',2B',1C',2E',
05520            $ 2C',2W',2P',2A',2E',  2S',2B',2C',2A',2E',  'E',2R',2R',2B',3E',
05530            $ 2A',2N',0D',2A',2E',  'N',2E',2G',2A',2E',  'L',2D',2A',2A',2E'/
05540             DATA P6/
05550            $ 'E',2R',2R',2B',2B',  'E',2W',2R',2A',2E',  2A',0D',2C',2A',2E',
05560            $ 2W',2R',2A',2A',2E',  2A',0D',2D',2A',2E',  2C',2P',2X',1C',1E',
05570            $ 2B',2S',2R',1C',2E',  2L',0D',2S',1C',1E',  'E',2R',2R',2B',2E',
05580            $ 2S',2U',2B',2A',0D',  2C',2W',2P',2A',0D',  2S',2B',2C',2A',0D',
05590            $ 'E',2R',2R',2W',3E',  2A',2N',0D',2A',0D',  2B',1C',1T',2A',0D',
05600            $ 'L',2D',2A',2A',0D',  2S',1C',2A',2A',0D',  'E',2W',2R',2A',0D',
05610            $ 2A',0D',2C',2A',0D',  0W',2R',2A',2A',0D',  2A',0D',0D',2A',0D',
05620            $ 2C',2P',2X',1C',0D',  2S',0U',2B',2A',1X',  2C',2W',2P',2A',1X'/
05630             DATA P7/
05640            $ 2S',2B',2C',2A',1X',  'E',2W',2R',2A',2E',  2A',2N',0D',2A',1X',
05650            $ 2B',1C',1T',2A',1X',  'L',2D',2A',2A',1X',  2S',1T',2A',2A',1X',
05660            $ 'E',2W',2R',2A',1X',  2A',0D',2C',2A',1X',  0W',2R',2A',2A',1X',
05670            $ 2A',0D',2D',2A',1X',  2C',2P',2X',1C',1X',  2J',2S',2R',1C',1X',
05680            $ 2L',0D',2S',1C',1X',  2S',0U',2B',2A',1E',  2C',2W',2P',2A',1E',
05690            $ 2C',2W',2P',2A',1E',  2S',2B',2C',2A',1E',  'E',2R',2R',2B',3E',
05700            $ 2A',2N',0D',2A',1E',  'E',2W',2R',2A',1E',  'L',2D',2A',2A',1E',
05710            $ 2S',1T',2A',2A',1E',  'E',2W',2R',2A',1E',  2A',0D',2C',2A',1E',
05720            $ 0W',2R',2A',2A',1E',  2A',0D',2D',2A',1E',  2C',2P',2X',1C',1E'/
     we will hit stop for about 2 mins in 5 mins     OPER
05740             DATA P8/
05750            $ 2P',2S',2B',1C',1E',  'L',2U',2S',1C',1E',  2S',1T',2S',1C',1E',
05760            $ 2S',2U',2B',2A',1E',  2C',2W',2P',2A',1E',  2S',2B',2C',2A',1E',
05770            $ 'E',2R',2R',2C',3E',  2A',2N',0D',2A',1E',  2B',1C',1T',2A',1E',
05780            $ 'L',2D',2A',2A',1E',  'E',2R',2W',2C',1E',  'E',2W',2R',2A',1E',
05790            $ 2A',0D',2C',2A',1E',  0W',2R',2A',2A',1E',  2A',0D',2D',2A',1E',
05800            $ 'E',2R',2R',2C',2E',  'E',2R',2W',2C',2E',  'L',2D',2X',1C',1E',
05810            $ 'E',2R',2R',2C',4E',  2S',0U',2B',2A',1E',  2C',2W',2P',2A',1E',
05820            $ 2S',2B',2C',2A',1E',  'E',2W',2R',2A',1E',  2A',2N',0D',2A',1E',
05830            $ 2B',1C',1T',2A',1E',  'L',2D',2A',2A',1E',  2S',1T',2A',2A',1E'/
05840             DATA P9/
05850            $ 'E',2W',2R',2A',1E',  2A',0D',2C',2A',1E',  0W',2R',2A',2A',1E',
05860            $ 2A',0D',0D',2A',1E',  'E',2W',2R',2D',2C',  'E',2R',2R',2D',1E',
05870            $ 'L',2D',2X',1C',1E',  2S',0U',2B',2A',1E',  2C',2W',2P',2A',1E',
05880            $ 2A',2N',0D',2A',1E',  2B',1C',1T',2A',1E',  'L',2D',2A',2A',1E',
05890            $ 2S',1T',2A',2A',1E',  'E',2W',2R',2A',1E',  2A',0D',2C',2A',1E',
05900            $ 0W',2R',2A',2A',1E',  2A',0D',2D',2A',1E',  'E',2R',2R',2E',1E',
05910            $ 'L',2D',2X',1C',1E',  2S',0U',2B',2A',1E',  2C',2W',2P',2A',1E',
05920            $ 'E',2R',2R',2E',2D',  'L',2U',2X',1C',1E',  2S',1T',2X',1C',1E',
05930            $ 2S',2U',2B',2B',2E',  2C',2W',2P',2B',2E',  2S',2B',2C',2B',2E'/
05940             DATA PA/
05950            $ 'E',2R',2R',2F',3E',  2A',2N',0D',2B',2E',  2B',1C',1T',2B',2E',
05960            $ 'L',2D',2A',2B',2E',  2S',1T',2A',2B',2E',  'E',2W',2R',2B',2E',
05970            $ 2A',0D',2C',2B',2E',  0W',2R',2A',2B',2E',  2A',0D',0D',2B',2E',
05980            $ 'E',2R',2R',2F',2C',  'E',2R',2R',2F',0D',  'L',2D',2X',1C',1E',
05990            $ 2S',1T',2X',1C',1E'/
06000             END
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CIRCLE INQUIRY NO. 87

ASSEMBLY LANGUAGE STRUCTURED PROGRAMMING — STARS

by Ed Keith

INTRODUCTION

The term Structured Programming has been a buzzword in computing circles for several years. It first caught national attention in a 1973 article in *Datamation* when David McCracken, whose books on programming are extremely popular with students in schools throughout the nation, promised a "Revolution in Programming."[1] Several articles in that December 1973 issue dealt with structured programming and most agreed that structured programming implied three things:

1. Simple straightforward code sequences
2. IF-THEN-ELSE logic
3. A loop control ability such as the DO-WHILE or DO-UNTIL

In other words, a structured program is one which utilizes these structures; but further, *a structured program is also one in which the GO TO is severely limited as being a harmful language element.*[2] Limiting the use of the GO TO statement has some interesting implications. First, it enforces a simple program logic structure with no fancy branches into a routine to share one or two lines of code among several routines. Secondly, it allows programs to be read "top-down," another popular buzzword but having a simple meaning: One should be able to start at the top of a program and read in a downward direction until reaching the end. In a program with abundant GO TO's, the reader must follow every leap from the mainline logic to see how this new code affects the program flow. In some programs these leaps are so numerous and confusing that they totally obscure the mainline of logic and earn for these programs the titles of "Can-of-Worms" or "Spaghetti-Bowl" programs.

A third term which rounds out the buzzword list is Modular Programming. A modular program is one which has been broken up into modules. It is generally admitted that humans have a limited ability to grasp long logical constructs or remember tedious numerical sequences. How many ten digit numbers have you memorized and can you speak with authority on the inner working of your home computer after having only read the manufacturer's description of the chips used in your machine? Module programming recognizes the problems of the programmer and the program reader in two ways. First, it implies that any programming task can be segmented in small, understandable units or modules, each module being a logical entity, a "stand alone" unit, complete in itself. Then it implies that these modules can be bound together into a larger, more complex, module called a program.[3] It should be clear that these modules resemble subroutines in the programming sense and that the mainline program invokes these subroutines in top-down fashion to effect the solution to a programming problem. All parts of the resulting program, the mainline driver and its associated subroutines, whether they be in-line or out-of-line, should be written with the three rules of structured coding in mind.

STRUCTURED PROGRAMMING IS BETTER

In a very simplistic sense a structured program is better because it is organized into understandable modules which means simpler debugging and easier reading. In many instances a program will require more time to debug than to code. Also, when the time comes to modify an existing program, one usually needs to relearn his own code or learn someone else's. The easier it is to read, learn or relearn a program, the easier it will be to maintain or change that program.

This case illustrates the argument. The Federal Systems Center, a group of IBMers who write programs for the Feds, write almost totally in structured code. The federal government programmers are reported to spend more of their time maintaining old programs than they do in writing new applications. Perhaps when we computer hobbyists have been writing programs for years we'll be in the same boat and be saying to ourselves, "Why didn't we start with structured code while we had the chance!"

USING STRUCTURED CODING TECHNIQUES TO GENERATE ASSEMBLY LISTINGS

The first step in writing structured assembly programs is to admit that fully structured programs cannot be written in most microprocessor assembly languages. When we get over that hurdle, however, we begin to write reasonably structured assembly-level programs. The assembly languages simply do not have IF-THEN-ELSE or loop constructs so we shall have to find alternate structures and improved techniques.

The best technique with which to begin a program is one that does not require any coding: the planning phase. Most of you will be happy to note that structured coding does not use a flowchart at this level. This is extremely important since my experience indicates that most flowcharts are drawn up for documentation purposes *after* the program has been debugged. A flowchart can be a very valuable planning aid when used correctly, but is not required at this level, rather we shall draw a hierarchy diagram. A hierarchy diagram resembles company organizational chart and differs from a flowchart in that it does not show logic but rather function. In a company organizational chart we would discover who was in charge of stock ordering and who his boss was and how and where the boss fits into the company hierarchy. Similar information is found in a program hierarchy diagram. We can discover which modules invoke a routine and which modules are in turn invoked but we shall not find under what circumstances they are invoked. A program hierarchy diagram uses only rectangles and straight lines to convey its message. It is drawn in a top-down fashion working from general to specific functions.

To illustrate the sequence let's look at a "structured" program. The program in question is "Shooting Stars" that first appeared in the May 1976 issue of BYTE. Since that issue contained an 8080 version of the program, I will do a 6800 version although the hierarchy diagram for the program would be the same regardless of the computer or even the language involved. Step one is quite easy—simply write the names of the program in a rec-

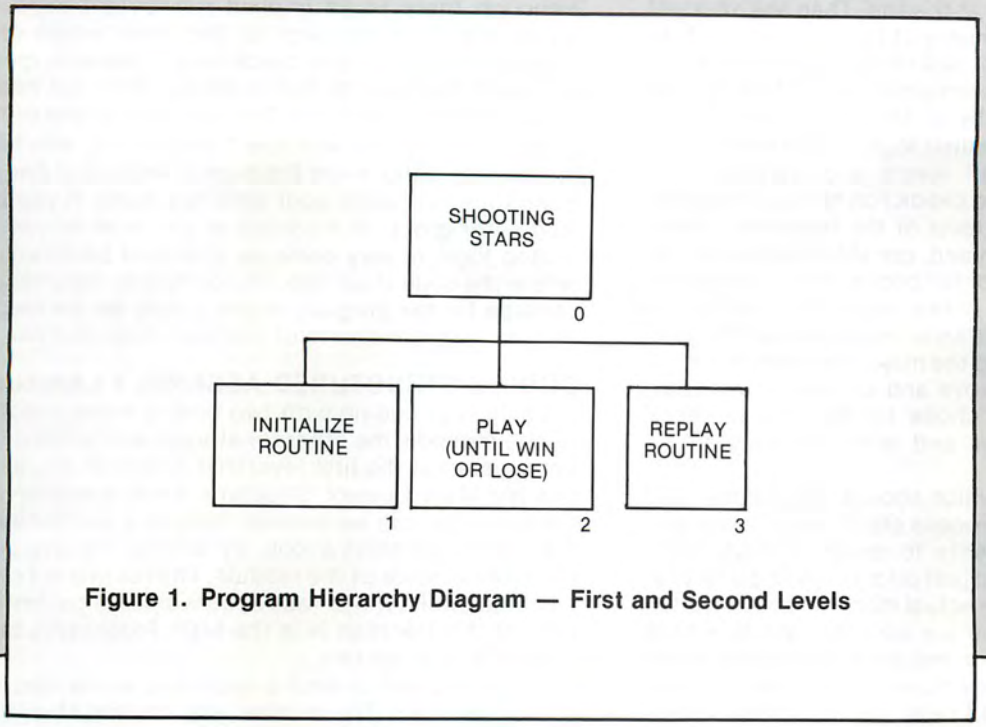

Figure 1. Program Hierarchy Diagram — First and Second Levels

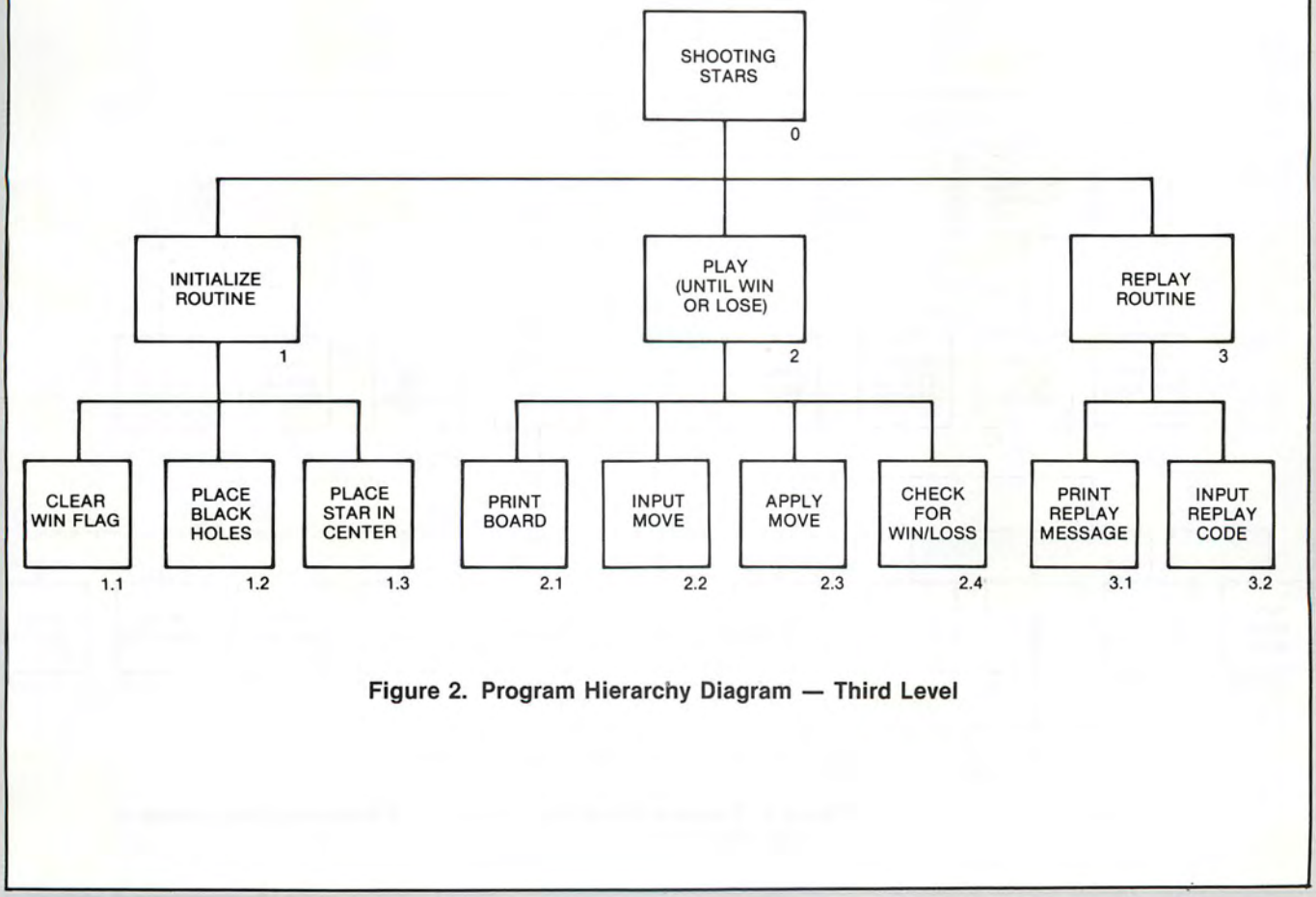

Figure 2. Program Hierarchy Diagram — Third Level

tangle at the top of a sheet of paper—preferably with the long edge of the paper at the top. Then ask yourself what are the major components of the program such as INITIALIZE ROUTINE, PLAY (UNTIL WIN OR LOSE) and CHECK FOR REPLAY. These very general components will become the second level in the hierarchy as shown in Figure 1.

Note that there is an implied logic in the left-to-right placement of items at all levels and that INITIALIZE ROUTINE would occur before CHECK FOR REPLAY in the program. To create the third level of the hierarchy, check each second level function and, considering it a task by itself, ask what are its major functions. In the case of INITIALIZE ROUTINE I selected CLEAR WIN FLAG, PLACE BLACK HOLES ON EDGES and PLACE STAR IN THE CENTER as the next level. Under PLAY! I selected the major components PRINT BOARD, INPUT MOVE, APPLY MOVE and CHECK FOR WIN/LOSE. The major components I chose for the REPLAY CHECK were PRINT REPLAY MESSAGE and INPUT REPLAY CODE as shown in Figure 2.

The burning questions which should now be troubling you are: "When does the process stop?" and "When do I stop writing sub-components to program modules?". The answer is that you stop just prior to writing a level at which the modules become actual machine code or, alternately, at a level where you are sure the task is simple enough to code easily. For instance, to further break down Module 1.1 CLEAR WIN FLAG would surely involve assembler level coding so I need go no further on that module. Similarly, Modules 1.2, 1.3, 2.1, 3.1 and 3.2 need no further refinement. Modules 2.2, 2.3 and 2.4 need further refinement and end up as shown in Figure 3 which indicates the total development. Let me emphasize the fact that a hierarchy diagram shows *function*, not *logic*. This is high-lighted in the breakout of Module 2.2. Although there is an implied left-to-right logic at all levels, the error message at this level would only be printed if the VALID MOVE CHECK failed. The error message is a valid *function* of this breakout level but need not always be encountered in the logic flow of the program.

For those readers who love flowcharting, who feel it's the neatest thing since Babbage's Analytical Engine or Hollerith's keypunch, your time has come. If you spot a module or group of modules at any level whose interrelated logic is very complex it should be flowcharted *before* the code is written. The complete documentation package for the program might simply be the hierarchy diagram and flowcharts of the non-trivial routines.

CODING STRUCTURED ASSEMBLY LANGUAGE

Begin your coding with two coding forms before you — one for code, the other for storage allocation descriptions. I start at the first level that is broken out, and call this my Main Control Structure. Each successive program module can be invoked through a subroutine call. If a module contains a loop, try to keep the loop control structure outside of the module. The routine PLAY will be repeated until a win or loss occurs and the control structure for this iteration is in the Main Processing Section not in the PLAY routine.

Force yourself to limit a routine to some reasonable number of lines. The number you choose should probably not exceed 55 lines as this is the usual page size for most printers but preferably should be less. Remember, it is extremely difficult to understand all but the most trivial assembler level routine when the coding takes more than one page.

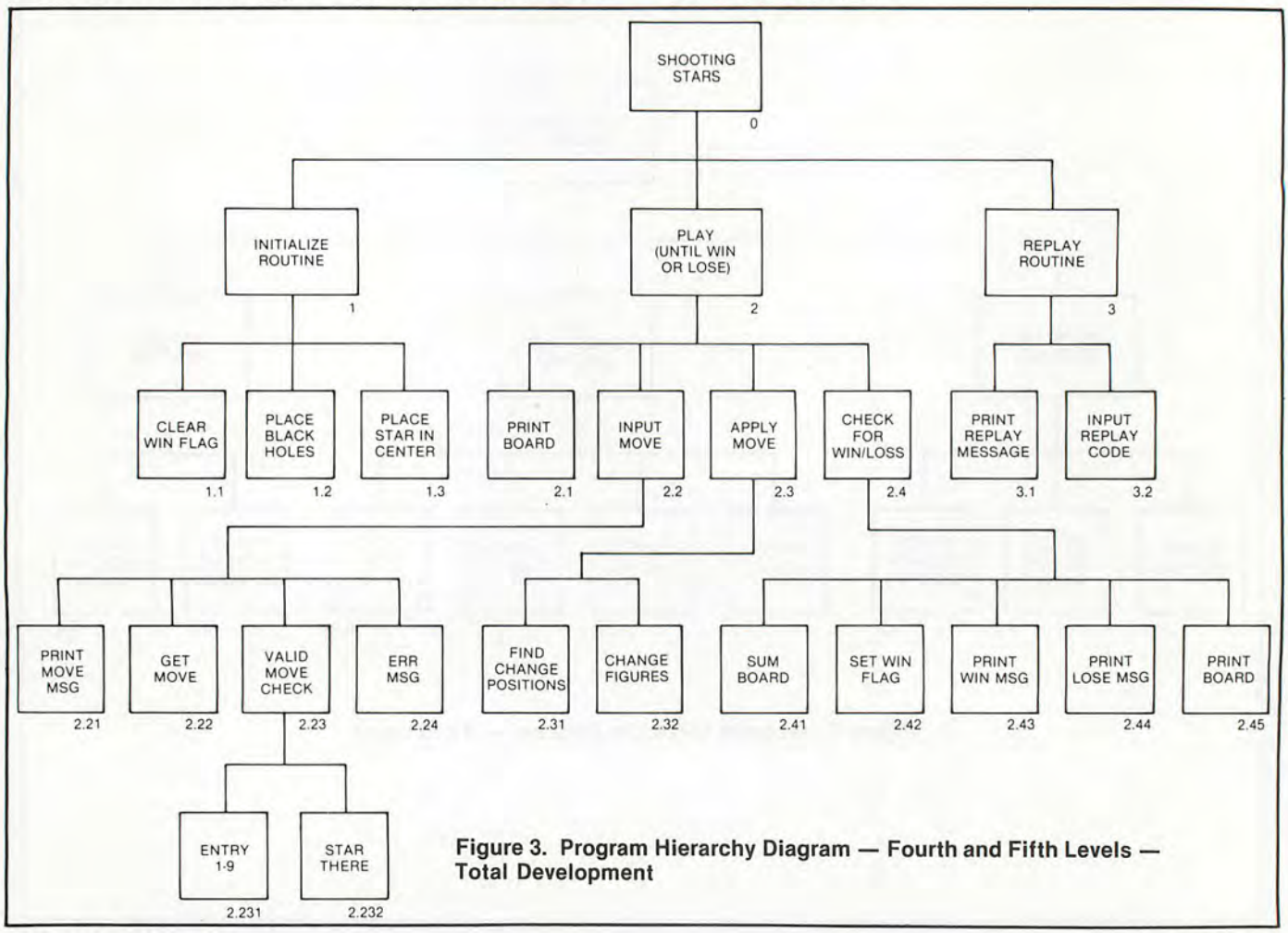

Figure 3. Program Hierarchy Diagram — Fourth and Fifth Levels — Total Development

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2102(650ns)	1.59
210211 sec)	1.40
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7400TTL

7400N	.15
7401N	.19
7402N	.18
7403N	.19
7404N	.19
7405N	.22
7406N	.29
7407N	.29
7408N	.25
7409N	.26
7410N	.18
7411N	.28
7412N	.39
7413N	.45
7414N	.68
7416N	.35
7417N	.35
7420N	.20
7421N	.33
7422N	.47
7423N	.37
7425N	.39
7426N	.35
7427N	.35
7428N	.49
7430N	.22
7432N	.31
7437N	.27
7438N	.27
7440N	.22
7441N	.85
7442N	.59
7443N	.75
7444N	.75
7445N	.75
7446N	.79
7447N	.65
7448N	.75
7450N	.22
7451N	.26
7453N	.26
7454N	.22
7459N	.29
7460N	.29
7470N	.44
7472N	.36
7473N	.36
7474N	.31
7475N	.48
7476N	.36
7479N	4.70
7480N	.59
7482N	.99
7483N	.70
7485N	.97
7486N	.39
7488N	3.95
7489N	2.25
7490N	.45
7491N	.65
7492N	.45
7493N	.45
7494N	.75
7495N	.79
7496N	.99
7497N	4.25
74100	.99
74104	.69
74105	.69
74107	.39
74109	.49
74121	.35
74122	.49
74123	.65
74125	.58
74126	.58
74132	1.05
74136	1.10
74141	1.10
74142	3.75
74143	3.95
74144	4.95
74145	1.05
74147	2.25
74148	1.79
74150	.95
74151	.75
74153	.90
74154	1.29
74155	.99
74156	.95
74157	.95
74158	1.79
74160	1.26
74161	.95
74162	.95
74163	.95
74164	1.05
74165	1.05
74166	1.00
74170	2.49
74172	8.49
74173	1.49
74174	1.25
74175	.90
74176	.90
74177	.90
74180	.89
74181	2.39
74182	.95
74184	2.10
74185	2.25
74186	14.50
74190	1.15
74191	1.15
74192	.99
74193	.99
74194	1.39
74195	.75
74196	1.19
74197	1.19
74198	1.69
74199	1.69
74200	5.95
74251	1.69
74279	1.10
74298	1.99
74365	.79
74366	.79
74367	.79
74368	.79

74LS00 TTL

74 LS00	.22
LS02	.24
LS04	.24
LS05	.28
LS08	.28
LS10	.28
LS13	.79
LS14	1.69
LS20	.26
LS27	.38
LS30	.26
LS32	.34
LS40	.26
LS42	1.10
LS51	.26
LS73	.56
LS74	.56
LS75	.79
LS76	.59
LS83	1.69
LS85	1.99
LS86	.55
LS90	1.10
LS92	1.10
LS93	1.10
LS95	1.69
LS107	.56
LS109	.56
LS112	.56
LS113	.56
LS123	.99
LS132	1.10
LS136	.99
LS138	1.39
LS139	1.49
LS151	1.49
LS153	1.29
LS155	1.49
LS157	1.29
LS158	1.29
LS161	1.39
LS162	1.39
LS163	1.39
LS164	1.39
LS174	1.39
LS175	1.39
LS180	2.49
LS181	2.49
LS191	2.49
LS192	2.49
LS193	2.49
LS194	2.49
LS195	.52
LS251	1.39
LS253	1.49
LS257	1.29
LS258	1.29
LS279	1.10
LS283	1.10
LS367	.99
LS368	.99
LS377	1.29

74S & 74L

74S00	.40
74S04	.42
74S08	.49
74S10	.40
74S11	.40
74S20	.40
74S30	.40
74S32	.78
74S37	.85
74S38	.95
74S40	.40
74S74	.79
74S138	1.69
74S139	1.69
74S151	1.49
74S153	1.49
74S174	1.59
74S175	1.59
74S189	2.95
74S201	3.95
74S251	1.69
74S257	1.69
74L00	.39
74L04	.39
74L10	.39
74L20	.39
74L30	.39
74L42	1.29
74L73	.89
74L74	.89
74L85	1.49
74L86	1.49
74L90	1.29
74L95	1.29
74L154	1.59
74L164	1.69
74L165	1.89
74L192	1.99
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CD4001	.25
CD4002	.25
CD4006	1.69
CD4007	.25
CD4008	1.69
CD4009	.55
CD4010	.55
CD4011	.25
CD4012	.25
CD4013	.55
CD4014	1.95
CD4015	1.95
CD4016	.55
CD4017	1.95
CD4018	2.39
CD4019	.55
CD4020	1.39
CD4021	1.85
CD4022	1.20
CD4023	.29
CD4024	1.25
CD4025	.29
CD4026	1.95
CD4027	.59
CD4028	1.50
CD4029	1.70
CD4030	.42
CD4033	2.49
CD4034	4.95
CD4035	1.79
CD4040	1.05
CD4041	1.95
CD4042	1.45
CD4043	1.45
CD4044	1.45
CD4047	1.95
CD4048	.61
CD4050	.61
CD4051	1.25
CD4052	1.25
CD4059	1.99
CD4063	2.49
CD4068	.35
CD4069	.35
CD4070	.35
CD4071	.35
CD4072	.35
CD4073	.35
CD4075	.35
CD4078	.35
CD4081	.40
CD4082	.40
CD4094	2.49
40160	2.10
40161	2.10
40174	2.10
4508	3.95
4510	1.99
4511	1.99
4515	3.95
4516	1.99
4518	1.99
4520	2.49
4522	2.56
4526	2.56
4527	2.69
4528	1.50
4531	1.99
4532	2.69
4543	2.25
4555	1.79
4556	1.79
4581	4.90
4582	1.99
4585	2.49
4901	.49
4911	.49
74C00	.35
74C04	.35
74C10	.35
74C20	.35
74C30	.35
74C42	1.95
74C48	2.90
74C73	.85
74C74	.85
74C76	1.39
74C85	1.25
74C86	1.79
74C89	4.95
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74C106	1.49
74C107	1.10
74C151	1.70
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LM710N	.70
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LM711CH	.49
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LM723CH	.55
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LM733N	1.00
LM733H	1.29
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LM741CH	.35
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For example in BASIC:

```
090  INPUT X
100  LET A = 7 + X
110  LET F = 19 + X
120  LET G = 27.5 + X
130  LET M = (F-G)/19.72
140  IF M > 16.7 THEN GO TO 170
150  LET F = F + 3.14159
160  GO TO 130
170  LET Q = F/A
```

The value of A as computed at Line 100 is not needed until Line 170 and is not dependent on any value of X except the input value and since X is not changed prior to 170 then the computation of A should immediately precede its use in the formula LET Q = F/A. This seems a minor point on the face of it, but can prove quite important when you are trying to decide exactly what the backward jump accomplishes. You might be so engrossed that you forget what A's value is, or if Line 100 is absent you might not notice that A has not been calculated. A good rule in programming might be: "Always put off 'til later what is not needed 'til later."

One last plea. If you have taken the time to draw a hierarchy diagram, please follow it. Well-planned programs tend to flow together and although they don't often *write themselves*, they usually work with a minimum of errors and changes. A hierarchy diagram forces you to think about the program in the way that is most logical, in a top-down fashion. It is far easier to modify than a flowchart and, I feel, communicates more clearly the interrelationships of routines within a program. When you have several, you should find them becoming the most important part of your programming effort.

READING A STRUCTURED PROGRAM

It doesn't take a gift to be able to *write* structured programs. But, the best way to *read* a structured program is to treat it as a gift. A structured program and a gift are both things of many layers. To get to the gift itself, you must remove the wrapping, open the box and dig the gift out of the tissue paper. Tackle a structured program in the same way. The gift of a structured program is its ability to make it easy for you to understand it. Begin reading by finding the first statement in the Main Control Structure, Line 500 in the source listing, and reading through the entire section until you get to Line 580. Your goal is to understand the logic of this section which shouldn't be too hard since there are only nine lines of annotated code. The first statement sends us off to a routine called INIT. You should fight the desire to plunge in at this point, and read INIT. Our goal *requires that we* peel off (understand) just one level at a time and since subroutine calls indicate another level, don't follow them right away.

The name of the subroutine should tell you its function and the comment should reinforce the name. The next three lines form the major program loop. The subroutine call to PLAYS will be repeated while the variable WINFLG is zero. In 6800 assembly language the BEQ means: branch if zero, so we return to the label LOOP while WINFLG remains zero. At this time you should assume that PLAYS in some way modifies WINFLG because if it doesn't this program will take a long while to run. The next four lines of this structure determines if a replay is desired, and if not, the last line jumps back to the monitor. Some of you may be thinking that several lines of code might be saved if the jump to CONTROL were contained in the replay routine itself and you're correct, they could. But this would violate an important rule in structured assembly language coding: a routine should have a single entry and a single exit. There can be multiple return points in a routine but since they always return to the statement following the subroutine call there is no conflict. However, a *return* and a *jump* to the monitor constitute two exit points and would violate the rule. Further, you will encounter many subroutine calls in most structured programs. Think how impossible it would be to read a program where the subroutine calls occasionally never came back!

STRUCTURED PROGRAM EFFICIENCY

By now you should thoroughly understand this first structure and also see the reason for keeping a routine short and simple: it is easier to read. When you get an understanding of one layer in the program structure you can then explore further. Look through INIT, it has a single entry point, a single exit and only ten lines of code so it must be simple, right? Look again! I coded INIT to be more complex than it might seem at first glance. First, I loaded the index register with the address of BOARD-1, which is one less than the address of BOARD. I next place a nine in the A register, then store this nine at CLEAR+1. Glance at Line 650 for a moment. You should notice that this is an indexed instruction, the 9,X indicates this. An indexed instruction builds its effective address, that is, the final address in storage where data will be affected, by adding the off-set in the instruction, 9, to the contents of the index register, BOARD-1, for a resultant of BOARD+8. The next instruction decrements CLEAR+1, in other words the 9 will become an 8. The computer will keep jumping back until the decrement results in a zero, at which time the computer will continue with the program. Frankly, these first few lines are somewhat confusing, even for an experienced programmer, and serve to illustrate how hard it can be to under-

```
00590              *
00600              * INITIALIZE ROUTINE - 9
00610              *
00620 00C9 CE 00AF INIT   LDX    #BOARD   POINT IP TO ADDRESS OF BOARD
00630 00CC 6F 00   CLEAR  CLR    0,X      CLEAR LOC POINTED TO BY IP
00640 00CE 08             INX             ADD 1 TO THE IP
00650 00CF 8C 00B1        CPX    #BOARD+9 DONE FAR ENOUGH?
00660 00D2 26 F8          BNE    CLEAR    :JUMP IF NOT
00670 00D4 86 01          LDA A  #$01     PUT A 1
00680 00D6 97 AC          STA A  BOARD+4  :IN THE CENTER
00690 00D8 7F 00F4        CLR    WINFLG   WIN FLAG = 0
00700 00DB 39             RTS
```

Figure 4.

stand some types of coding. Let's look at a simpler approach (see Figure 4).

This routine is shorter by one line and one byte. But more importantly, it is easier to understand. The index register is set to the address of BOARD; that location is cleared. The index register is set up by one. The index register is compared to BOARD+9 and if this address is not reached the program jumps back to CLEAR. The remainder of the routine is the same as the original. I think you will admit that this is clearer. But is this the best approach? Let's look at the third INIT (in Figure 5).

```
00590                    *
00600                    * INITIALIZE ROUTINE - 3
00610                    *
00620 00C9 7F 00A8 INIT  CLR     BOARD    CLEAR
00630 00CC 7F 00A9       CLR     BOARD+1  :THE
00640 00CF 7F 00AA       CLR     BOARD+2  :OUTER
00650 00D2 7F 00AB       CLR     BOARD+3  :EDGES
00660 00D5 7F 00AD       CLR     BOARD+5  :OF
00670 00D8 7F 00AE       CLR     BOARD+6  :THE
00680 00DB 7F 00AF       CLR     BOARD+7  :PLAYING
00690 00DE 7F 00B0       CLR     BOARD+8  :BOARD
00700 00E1 86 01         LDA A   #$01     PUT A 1
00710 00E3 97 AC         STA A   BOARD+4  :IN THE CENTER
00720 00E5 7F 00B4       CLR     WINFLG   WIN FLAG = 0
00730 00E8 39            RTS
```

Figure 5.

This routine is longer in statements and bytes than either of the first two, but is even more clear and simple. It also has a hidden benefit. If you compute the number of machine cycles and instructions it takes to complete each of the three routines, some interesting comparisons arise. The original routine took 181 machine cycles and, because of the loop, 34 instruction executions. The second took 183 machine cycles and 41 instruction executions. The last requires only 66 machine cycles to execute 12 instructions. Conclusion: Loops are easy to code but expensive in machine time. Obviously when you are clearing a 1,000-position table, or repeating some statements an unknown number of times, a loop is the only answer, but use them judiciously.

FINAL NOTES ON STRUCTURED PROGRAMMING

The last documentation step can be accomplished while the program is being written. This is documentation of sentinel variables and their values. We must select representations for stars and black holes. What values of a win flag are meaningful? Proper selection of these values can simplify coding the program. For example, in this program a star is represented by a 1 and a black hole by a 0. This makes it easy to switch the values. If X = a star or a black hole then 1-X is its opposite. A win flag value of zero means no win or loss, minus one equals a loss and plus one a win. Include these kinds of comments in your documentation to guarantee the clearest communication. Remember, someday you might have to read your own program.

STARS PROGRAM

If you wish to enter this version of stars into your 6800, I have included a listing of the object code from which you can work. The object code is shown in P (punch) format and should be familiar to you. Simply reset your machine and type L (be sure your cassette interface is off at this point). Enter each line that begins with an S1. When you come to the end of a line, return the carriage if you wish. If you have made a mistake, the operating system will print a question mark at the end of the line. Simply reenter the line in question and continue. After entering the last line, key in S9 to get out of the load mode. To execute the program simply type a G since the first line of the object program as set A048 to the start address 00B5.

If all has been successful, your output should resemble my sample output. I've included the easiest loss (sometimes, in the middle of a game, it's as hard to lose as win) and a hint at a winning pattern.

Let me close by asking that you read my program, compare it to the hierarchy diagram, search for my favorite "coding tricks." If you like them, adopt them. If you feel they are counter-productive, write a letter to the editor. Let's begin to expose ourselves to the best and worst in each other's code and hope that from the exchange the home computerist will benefit.

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STARS PROGRAM ASSEMBLY LISTING

```
00010                    NAM   STARS
00020                    *
00030                    * REVISION 1.1
00040                    * WRITTEN BY - LE KEITH
00050                    *            - SOUTHWEST MICRO SYSTEMS CORP (SMSC)
00060                    *
00070                          OPT   O,S,NOC
00080 0020                     ORG   $0020
00090                    *
00100                    * POINTERS TO ROUTINES IN MIKBUG
00110                    *
00120      E0E3    CONTRL EQU   $E0E3    MIKBUG ENTRY POINT
00130      E1AC    INEEE  EQU   $E1AC    INPUT CHAR, PUT IN REG A
00140      E1D1    OUTEEE EQU   $E1D1    OUTPUT A CHAR FROM REG A
00150      E0CC    OUTS   EQU   $E0CC    PRINT A SPACE
00160      E07E    PDATA1 EQU   $E07E    PRINT A STRING TIL AN EOT
00170                    *
00180                    * PRINT LITERALS
00190                    *
00200 0020 0D       AGAIN  FCB   $D,$A,$A
00210 0023 50              FCC   /PLAY AGAIN? (Y OR N) /
00220 0038 04              FCB   4
00230 0039 3A       CHRTAB FCC   /:*/
00240 003B 0D       CRLF   FCB   $D,$A,4
00250 003E 0D       NGMSG  FCB   $D,$A,$10,$15,0,4
00260 0044 20       ILLENT FCC   / ILLEGAL ENTRY/
00270 0052 04              FCB   4
00280 0053 0D       LOCATE FCB   $D,$A,$16
00290 0056 45              FCC   /ENTER LOCATION TO SHOOT /
00300 006E 04              FCB   4
00310 006F 20       NOSTAR FCC   / NO STAR THERE/
00320 007D 04              FCB   4
00330 007E 0D       CLOSE  FCB   $D,$A
00340 0080 53              FCC   /SORRY - YOU LOSE/
00350 0090 04              FCB   4
00360 0091 0D       WIN    FCB   $D,$A
00370 0093 57              FCC   /WELL DONE - YOU WIN!/
00380 00A7 04              FCB   4
00390                    *
00400                    * WORK AREAS
00410                    *
00420 00A8 0009     BOARD  RMB   9
00430 00B1 0001     MOVEB  RMB   1
00440 00B2 0001     PLAY   RMB   1
00450 00B3 0001     VALPLA RMB   1
00460 00B4 0001     WINFLG RMB   1
00470                    *
00480                    * MAIN CONTROL STRUCTURE
00490                    *
00500 00B5 8D 12    START  BSR   INIT     SET UP FOR PLAY
00510 00B7 8D 27    LOOP   BSR   PLAYS    PLAY
00520 00B9 96 B4           LDA A WINFLG  :UNTIL A
00530 00BB 27 FA           BEQ   LOOP    :WIN OR LOSS
00540 00BD BD 0240         JSR   REPLAY  CHECK FOR REPLAY
00550 00C0 96 B2           LDA A PLAY    BRANCH TO
00560 00C2 81 59           CMP A #'Y     :START IF
00570 00C4 27 EF           BEQ   START   :YES
00580 00C6 7E E0E3         JMP   CONTRL
00590                    *
00600                    * INITIALIZE ROUTINE
00610                    *
00620 00C9 CE 00A7  INIT   LDX   #BOARD-1 POINT TO BE-1
00630 00CC 86 09           LDA A #$09    :INIT THE
00640 00CE E7 00D2         STA A CLEAR+1 :OFFSET
00650 00D1 6F 09    CLEAR  CLR   9,X     BD POS = 0
00660 00D3 7A 00D2         DEC   CLEAR+1 BACK UP 1
00670 00D6 26 F9           BNE   CLEAR   BRANCH IF NOT DONE
00680 00D8 86 01           LDA A #$01    PUT A 1
```

```
00690 00DA 97 AC          STA A  BOARD+4  :IN THE CENTER
00700 00DC 7F 00B4        CLR    WINFLG   WIN FLAG=0
00710 00DF 39             RTS
00720                *
00730                * PLAY ROUTINE
00740                *
00750 00E0 8D 0C   PLAYS  BSR    BDPRNT   PRINT BOARD
00760 00E2 8D 5D   PLAYIN BSR    GETPLA   GET A PLAY
00770 00E4 96 B3          LDA A  VALPLA   VALID?
00780 00E6 26 FA          BNE    PLAYIN   BRANCH IF NOT
00790 00E8 BD 0175        JSR    MOVE     MAKE THE MOVE
00800 00EB BD 020E        JSR    WINLOS   WIN OR LOSS?
00810 00EE 39             RTS
00820                *
00830                * PRINT THE BOARD - HOME UP 1ST
00840                *
00850 00EF CE 003E BDPRNT LDX    #HOMEUP  PRINT A
00860 00F2 BD E07E        JSR    PDATA1   :HOME UP
00870 00F5 8D 01          BSR    BDOUT    PRINT BOARD
00880 00F7 39             RTS
00890                *
00900                * PRINT THE BOARD (0=: AND 1=*)
00910                *
00920 00F8 CE 003B BDOUT  LDX    #CRLF    PRINT A CR AND
00930 00FB BD E07E        JSR    PDATA1   :AN LF
00940 00FE 96 A8          LDA A  BOARD    LOAD
00950 0100 8D 2D          BSR    PRINT    :AND
00960 0102 96 A9          LDA A  BOARD+1  :PRINT
00970 0104 8D 29          BSR    PRINT    :1ST
00980 0106 96 AA          LDA A  BOARD+2  :3
00990 0108 8D 25          BSR    PRINT    :POS OF BD
01000 010A CE 003B        LDX    #CRLF    PRINT A CR AND
01010 010D BD E07E        JSR    PDATA1   :AN LF
01020 0110 96 AB          LDA A  BOARD+3  LOAD
01030 0112 8D 1B          BSR    PRINT    :AND
01040 0114 96 AC          LDA A  BOARD+4  :PRINT
01050 0116 8D 17          BSR    PRINT    :MIDDLE
01060 0118 96 AD          LDA A  BOARD+5  :3
01070 011A 8D 13          BSR    PRINT    :POS OF BD
01080 011C CE 003B        LDX    #CRLF    PRINT A CR AND
01090 011F BD E07E        JSR    PDATA1   :AN LF
01100 0122 96 AE          LDA A  BOARD+6  LOAD
01110 0124 8D 09          BSR    PRINT    :AND
01120 0126 96 AF          LDA A  BOARD+7  :PRINT
01130 0128 8D 05          BSR    PRINT    :LAST
01140 012A 96 B0          LDA A  BOARD+8  :3
01150 012C BD 01          BSR    PRINT    :POS OF BD
01160 012E 39             RTS
01170                *
01180                * PRINT 2 SPACES AND A : OR *
01190                *
01200 012F B7 013C PRINT  STA A  OUT+1    INIT OFFSET
01210 0132 BD E0CC        JSR    OUTS     PRINT
01220 0135 BD E0CC        JSR    OUTS     :2 SPACES
01230 0138 CE 0039        LDX    #CHRTAB  POINT IR TO CHAR TBL
01240 013B A6 00   OUT    LDA A  0,X      PICK UP CHAR
01250 013D BD E1D1        JSR    OUTEEE   :AND PRINT IT
01260 0140 39             RTS
01270                *
01280                * MOVE INPUT ROUTINE
01290                *
01300 0141 7F 00B3 GETPLA CLR    VALPLA   CLEAR PLAY FLAG
01310 0144 CE 0053        LDX    #LOCATE  PRINT LOC
01320 0147 BD E07E        JSR    PDATA1   :MSG
01330 014A BD E1AC        JSR    INEEE    GET PLAY
01340 014D 81 30          CMP A  #'0      BRANCH IF PLAY
01350 014F 2E 08          BGT    PLACHK   :> 0
01360 0151 CE 0044 PLAERR LDX    #ILLENT  PRINT ILLEGAL
01370 0154 BD E07E        JSR    PDATA1   :ENTRY MSG
01380 0157 20 16          BRA    ERROUT   :AND RETURN
01390 0159 81 39   PLACHK CMP A  #'9      BRANCH IF
01400 015B 2E F4          BGT    PLAERR   :PLAY > 9
01410 015D 84 0F          AND A  #$0F     STRIP OFF HI ORD NIBBLE
01420 015F 97 B1          STA A  MOVEE    SAVE MOVE IN BINARY
01430 0161 B7 0168        STA A  STARLK+1 SET UP OFFSET
01440 0164 CE 00A7        LDX    #BOARD-1 POINT IR TO BD-1
01450 0167 A6 00   STARLK LDA A  0,X      PICK UP PLAY LOC
01460 0169 26 09          BNE    RETN1    BRANCH IF NOT 0
01470 016B CE 006F        LDX    #NOSTAR  PRINT
01480 016E BD E07E        JSR    PDATA1   :NO STAR MSG
01490 0171 7C 00B3 ERROUT INC    VALPLA   SET ERR FLAG
01500 0174 39      RETN1  RTS
01510                *
01520                * APPLY THE MOVE
01530                *
01540 0175 96 B1   MOVE   LDA A  MOVEE    LOAD MOVE
01550 0177 4A             DEC A          :SUBT 1
01560 0178 48             ASL A          :MULT BY 2
01570 0179 B7 0180        STA A  JUMP+1   SETUP OFFSET
01580 017C CE 0181        LDX    #GOTAB   IR=ADDR OF GOTAB
01590 017F 6E 00   JUMP   JMP    0,X      JUMP (MOVEB-1)*2 BYTES AHEAD
01600                *
01610                * GO TO ONE,TWO,...,NINE DEPENDING ON THE
01620                *   VALUE OF MOVEB
01630                *
01640 0181 20 16   GOTAB  BRA    ONE
01650 0183 20 1C          BRA    TWO
01660 0185 20 20          BRA    THREE
01670 0187 20 26          BRA    FOUR
01680 0189 20 2A          BRA    FIVE
01690 018B 20 32          BRA    SIX
01700 018D 20 36          BRA    SEVEN
01710 018F 20 3C          BRA    EIGHT
01720 0191 8D 5D   NINE   BSR    X5       A 9 SHOT
01730 0193 8D 60          BSR    X6
01740 0195 8D 68          BSR    X8
01750 0197 20 38          BRA    CLRPLA
01760 0199 8D 46   ONE    BSR    X2       A 1 SHOT
01770 019B 8D 4E          BSR    X4
01780 019D 8D 51          BSR    X5
01790 019F 20 30          BRA    CLRPLA
01800 01A1 8D 39   TWO    BSR    X1       A 2 SHOT
01810 01A3 8D 41          BSR    X3
01820 01A5 20 2A          BRA    CLRPLA
01830 01A7 8D 36   THREE  BSR    X2       A 3 SHOT
01840 01A9 8D 45          BSR    X5
01850 01AB 8D 48          BSR    X6
01860 01AD 20 22          BRA    CLRPLA
01870 01AF 8D 2B   FOUR   BSR    X1       A 4 SHOT
01880 01B1 8D 47          BSR    X7
01890 01B3 20 1C          BRA    CLRPLA
01900 01B5 8D 2A   FIVE   BSR    X2       A 5 SHOT
01910 01B7 8D 32          BSR    X4
01920 01B9 8D 3A          BSR    X6
01930 01BB 8D 42          BSR    X8
01940 01BD 20 12          BRA    CLRPLA
01950 01BF 8D 25   SIX    BSR    X3       A 6 SHOT
01960 01C1 8D 41          BSR    X9
01970 01C3 20 0C          BRA    CLRPLA
01980 01C5 8D 24   SEVEN  BSR    X4       A 7 SHOT
01990 01C7 8D 27          BSR    X5
02000 01C9 8D 34          BSR    X8
02010 01CB 20 04          BRA    CLRPLA
02020 01CD 8D 2B   EIGHT  BSR    X7       AN 8 SHOT
02030 01CF 8D 33          BSR    X9
02040 01D1 96 B1   CLRPLA LDA A  MOVEB    LOAD MOVE
02050 01D3 B7 01DA        STA A  CLRSTR+1 SET UP OFFSET
02060 01D6 CE 00A7        LDX    #BOARD-1 IR=BD-1
02070 01D9 6F 00   CLRSTR CLR    0,X      REMOVE STAR
02080 01DB 39             RTS
02090                *
02100                * THESE ROUTINES INVERT THE * OR :
02110                *
02120 01DC CE 00A8 X1     LDX    #BOARD   SWITCH
02130 01DF 20 26          BRA    SWITCH   :POS 1
02140 01E1 CE 00A9 X2     LDX    #BOARD+1 SWITCH
02150 01E4 20 21          BRA    SWITCH   :POS 2
02160 01E6 CE 00AA X3     LDX    #BOARD+2 ETC.
02170 01E9 20 1C          BRA    SWITCH   ETC...
02180 01EB CE 00AB X4     LDX    #BOARD+3
02190 01EE 20 17          BRA    SWITCH
02200 01F0 CE 00AC X5     LDX    #BOARD+4
02210 01F3 20 12          BRA    SWITCH
02220 01F5 CE 00AD X6     LDX    #BOARD+5
02230 01F8 20 0D          BRA    SWITCH
02240 01FA CE 00AE X7     LDX    #BOARD+6
02250 01FD 20 08          BRA    SWITCH
02260 01FF CE 00AF X8     LDX    #BOARD+7
02270 0202 20 03          BRA    SWITCH
02280 0204 CE 00B0 X9     LDX    #BOARD+8
02290 0207 86 01   SWITCH LDA A  #1       REG A = 1
02300 0209 A0 00          SUB A  0,X      REG A = 1 - X
02310 020B A7 00          STA A  0,X      X= REG A
02320 020D 39             RTS
02330                *
02340                * CHECK FOR A WIN OR LOSS
02350                *
02360 020E 4F      WINLOS CLR A           REG A = 0
02370 020F CE 00A8        LDX    #BOARD   POINT IR TO BD
02380 0212 AB 00   ADDIT  ADD A  0,X      ADD ELEM POS TO REG A
02390 0214 08             INX             MOVE UP 1
02400 0215 8C 00B1        CPX    #BOARD+9 ALL DONE?
02410 0218 26 F8          BNE    ADDIT    :BRANCH IF NOT
02420 021A 81 00          CMP A  #0       LOSS?
02430 021C 26 0B          BNE    NXTCHK   :BRANCH IF NOT
02440 021E 7A 00B4        DEC    WINFLG   SET LOSS CODE
02450 0221 CE 007E        LDX    #LOSE    PRINT
02460 0224 BD E07E        JSR    PDATA1   :LOSS MSG
02470 0227 BD 00F8 FINPRT JSR    BDOUT    PRINT BOARD
02480 022A 39             RTS
02490 022B 81 08   NXTCHK CMP A  #8       POSS WIN?
02500 022D 27 01          BEQ    WINCHK   :BRANCH IF YES
02510 022F 39             RTS
02520 0230 96 AC   WINCHK LDA A  BOARD+4  CENTER=0?
02530 0232 27 01          BEQ    WINSET   :BRANCH IF YES
02540 0234 39             RTS
02550 0235 7C 00B4 WINSET INC    WINFLG   SET WIN CODE
02560 0238 CE 0091        LDX    #QWIN    PRINT
02570 023B BD E07E        JSR    PDATA1   :WIN MSG
02580 023E 20 E7          BRA    FINPRT
02590                *
02600                * REPLAY ROUTINE
02610                *
02620 0240 CE 0020 REPLAY LDX    #AGAIN   PRINT
02630 0243 BD E07E        JSR    PDATA1   :REPLAY MSG
02640 0246 BD E1AC        JSR    INEEE    GET A CHAR
02650 0249 81 59          CMP A  #'Y      BRANCH IF
02660 024B 27 06          BEQ    RETN     :Y
02670 024D 81 4E          CMP A  #'N      BRANCH IF
02680 024F 27 02          BEQ    RETN     :Y
02690 0251 20 ED          BRA    REPLAY   IF NEITHER
02700 0253 97 B2   RETN   STA A  PLAY     SAVE PLAY
02710 0255 39
02720
CONTRL E0E3
INEEE  E1AC
OUTEEE E1D1
OUTS   E0CC
PDATA1 E07E
AGAIN  0020
CHRTAB 0039
CRLF   003B
HOMEUP 003E
ILLENT 0044
LOCATE 0053
NOSTAR 006F
QUOSE  007E
QWIN   0091
BOARD  00A8
MOVEB  00B1
PLAY   00B2
VALPLA 00B3
WINFLG 00B4
START  00B5
LOOP   00B7
INIT   00C9
CLEAR  00D1
PLAYS  00E0
PLAYIN 00E2
BDPRNT 00EF
BDOUT  00F8
PRINT  012F
```

```
OUT     Ø13B
GETPLA  Ø141
PLAERR  Ø151
PLACUK  Ø159
STARLK  Ø167
ERROUT  Ø171
RETNI   Ø174
MOVE    Ø175
JUMP    Ø17F
GOTAB   Ø181
NINE    Ø191
ONE     Ø199
TWO     Ø1A1
THREE   Ø1A7
FOUR    Ø1AF
FIVE    Ø1B5
SIX     Ø1BF
SEVEN   Ø1C5
EIGHT   Ø1CD
CLRPLA  Ø1D1
CLRSTR  Ø1D9
X1      Ø1DC
X2      Ø1E1
X3      Ø1E6
```

STARS PROGRAM RUN EXAMPLES

```
SHØØTING STARS - SAMPLE WIN!

  : : :
  : * :
  : : :
ENTER LØCATIØN TØ SHØØT 5

  : * :
  * : *
  : * :
ENTER LØCATIØN TØ SHØØT 2
      .
SEVERAL MØVES LATER!
      .

  : : :
  : * *
  * * :
ENTER LØCATIØN TØ SHØØT 5

  : * :
  * : :
  * : :
ENTER LØCATIØN TØ SHØØT 7

  : * :
  : * :
  : * :
ENTER LØCATIØN TØ SHØØT 2

  * : *
  : * :
  : * :
ENTER LØCATIØN TØ SHØØT 8

  * : *
  : * :
  * : *
ENTER LØCATIØN TØ SHØØT 5
WELL DØNE - YØU WIN!
  * * *
  * : *
  * * *

PLAY AGAIN? (Y ØR N) N
*
```

STARS PROGRAM RUN EXAMPLES

```
SHØØTING STARS - SAMPLE LØSS

  : : :
  : * :
  : : :
ENTER LØCATIØN TØ SHØØT 5

  : * :
  * : *
  : * :
ENTER LØCATIØN TØ SHØØT 1 NØ STAR THERE
ENTER LØCATIØN TØ SHØØT 2

  * : *
  * : *
  : * :
ENTER LØCATIØN TØ SHØØT 8

  * : *
  * : *
  * : *
ENTER LØCATIØN TØ SHØØT 4

  : : *
  : : *
  : : *
ENTER LØCATIØN TØ SHØØT 6
SØRRY - YØU LØSE
  : : :
  : : :
  : : :

PLAY AGAIN? (Y ØR N) N
```

STARS PROGRAM OBJECT LISTING

```
*P
S11300200D0A0A504C415920414741494E3F20286E
S113003059204F52204E2920043A2A0D0A040D0A51
S11300401015000426494C4C4547414C20454E5462
S11300505259040D0A16454E544552204C4F434103
S113006054494F4E20544F2053484F4F542004209E
S11300704E4F2053544152205448455245040D0AE2
S1130080534F525259202D20594F55204C4F534510
S1130090040D0A57454C4C20444F4E45202D205901
S11300A04F552057494E2104000000000000000075
S11300B00000064E00FF8E126E27968427FABE02402C
S11300C096B2815927EF7EE0E3CEE0A78669B780F8
S11300D0D26F0E7A00E226F98660197AC7F00B4393A
S11300E0E08E0D8D5D96B326FABD0175BD020E39CE18
S11300F0063EBDE07E8D0139CE003BBDE07E96A67A
S113010008E2E96A9EE2996AA6D25CE003BBDE07E26
S1130110096AB6E1E96AC8D1796AD8D13CE003EBD63
S1130120E67E96AE8D0996AF8D0596B08E0139B7F8
S1130130013CEDE0CCBDE0CCCE0039A600BDE1D190
S1130140397F00B3CE0053BDE07EBDE1AC81302EDB
S113015006CE0044BDE07E201881392EF4840F9728
S1130160B1E70168CE00A7A6062609CE006FBDE090
S113017007E7C00B33996E14A48B70180CE01816EC6
S11301800A2016201C20202026202A203220362057
S1130190 3C8D5C8D608D6626388D468D4E8D51204F
S11301A0308D398D41202A8D388D458D4820226D02
S11301B02B6D47201C8D2A8D328D3A8D4220128D35
S11301C0258D41200C8D248D278D3420048D2B8D7D
S11301D03396B1B701DACE00A76F0639CE00A62056
S11301E026CE00A92621CE00AA201CCE00AB2017C9
S11301F0CE00AC2012CE00AD200DCE00AE2008CE35
S113020000AF2003CE00B08601A600A700394FCE76
S113021006A8AB00C88C0EE126F88100260D7A00F6
S1130220B4CE007EBDE07EBE00F8398108270139D7
S113023096AC2701397C00B4CE0091BDE07E20E766
S11302400CE0020BDE07EBDE1AC81592706614E275A
S10902500220ED97B23913
*
```

VIDEO CHASE FOR 8080/VDM

by Joseph Jay Sanger

The score is continually displayed on the lower right corner of the display. The first 'team' to reach 9 games wins the series. At the completion of a game, type any key at all to begin a new one.

You must specify the level of difficulty of each game at the beginning of the series by typing a number from zero to nine (0 is the easiest; 9 is the hardest level). The factors differentiating an 'easy' game from a 'hard' one are twofold: first, the number of posts decreases as the game gets harder; second, the 'panic' button, (described below) behaves differently.

You can change the level of difficulty at any time by hitting the carriage return (ODH); you can abort the current series and begin a new one (with score 0:0) by typing 'ESC' (1BH).

If you really get into a bind, I have included a 'panic' button. By typing 'P,' you may be lucky enough to be instantaneously transported out of danger to a new (random) position — but the probability of a successful transport depends on the level of difficulty of the game — approximately 50% for level 0 down to a mere 12.5% at level 9! At level 9, there is also an additional penalty for use of this feature: several dead robots may regenerate!

One difference from other versions of chase — if two robots collide in this version, they do not annihilate, but travel as a pair — with some strangely unpredictable consequences! (This was originally a 'bug' in my program, but so neat that I decided to leave it in!)

Hardware specifications for my version include:

- VDM sitting at 0CC00H
  control port 0C8H
  (This is the standard configuration)
- 3P + S with status port 0
  data port 1
  DAV 40H (goes high on keypress)
- RAM req'd: 0600H RAM (1.5K bytes)
  (excluding stack space)

Other hardware in my system include:

- IMSAI™ 8080 computer
- Proc. Tech. ALS-8 development system & SIM-1, TXT-2
- Additional 36K RAM
- 5K EPROM (6834's — the mountain hardware 'PROPROM' board is a honey!)
- Tarbell Cassette Interface
- LS36-II Decwriter

If there is any interest, I plan to write two more versions of the game — one allowing two players to compete and the other making the robots move in real time, demanding constant evasive action on your part.

There are many other games that can be adapted to run on memory-mapped video displays with great success. A case in point is Processor Technology's TREK-80 — a really fine version of STAR TREK. I would particularly like to see some adventurous soul rewrite 'Hunt the Wumpus' for the VDM, although the 3-dimensional cave structure would be a mite difficult to depict in 2-D!

I hope this article heralds the appearance of many more along the same lines — programs to utilize more fully the rather impressive capabilities of the hardware that we own.

There have been many interesting games published to run on personal computers. However, since they are written in BASIC, the majority assume the existence of a TTY or a TTY-like device; i.e., a display device utilizing a 'line-at-a-time' scrolling mode of display. This mode of display seriously detracts from the realism of many game situations, especially games played on 'fields' of many sorts — whether they be bowling alleys, wumpus caves, or space quadrants.

There is a solution. Those of us who are lucky enough to have memory-mapped video displays — and those who happen to own Processor Technology VDM-1's in particular will be able to take advantage of this program.

I was particularly intrigued by the game 'Chase,' recently published in KILOBAUD, Issue #2 (written in BASIC by Herman DeMonstoy). The scenario of the game places you in an area enclosed on all four sides by a high-voltage fence, and studded with a number of high-voltage 'posts.' Also in residence are five security robots whose mission is to seek and destroy you. Every time you make a move, each robot likewise makes a move, taking the shortest, most direct path towards you. If one succeeds in reaching your position, you will be 'eliminated' — (permanently — or at least till you start a new game!). Your only chance for survival is to move cleverly about so as to maneuver each robot into one of the high-voltage posts (at which point the robot is 'eliminated'). Naturally, if you bump into either the posts or the fence, you will fry. Your "death" is depicted on the screen by a peculiar little symbol from inside VDM's 6574 ROM — it looked to me a little like a clump of flowers, not unlike the kind often seen at gravesites.

My version is written in 8080 Assembly Language specifically for the Processor Technology VDM-1 (I am sure that with a little elbow grease, it could be adapted to run on other memory-mapped video devices; e.g., PolyMorphic, Solid State Music, or home brew boards). It has several differences from any previously published version of the game with which I am familiar. Movement about the field is accomplished by typing the key on your keyboard corresponding to the desired direction — see the compass rose below.

This compass rose is continually displayed in the upper-right corner of the screen during the game.

Note: you can remain in place by typing 'H'. The various 'players' are represented on the screen as:

⊙ = You
웃 = Robots
X = Fence/Posts

The computer apprises you of important information as it develops by displaying messages below the playing field:

CAUTION — ROBOT NEAR!
YOU HAVE BEEN DESTROYED!
CONGRATULATIONS — YOU HAVE WON!

At the end of a series, the computer displays the final tally:

THE ROBOTS HAVE WON — 9:4
OR
YOU HAVE BEATEN THEM — 9:7

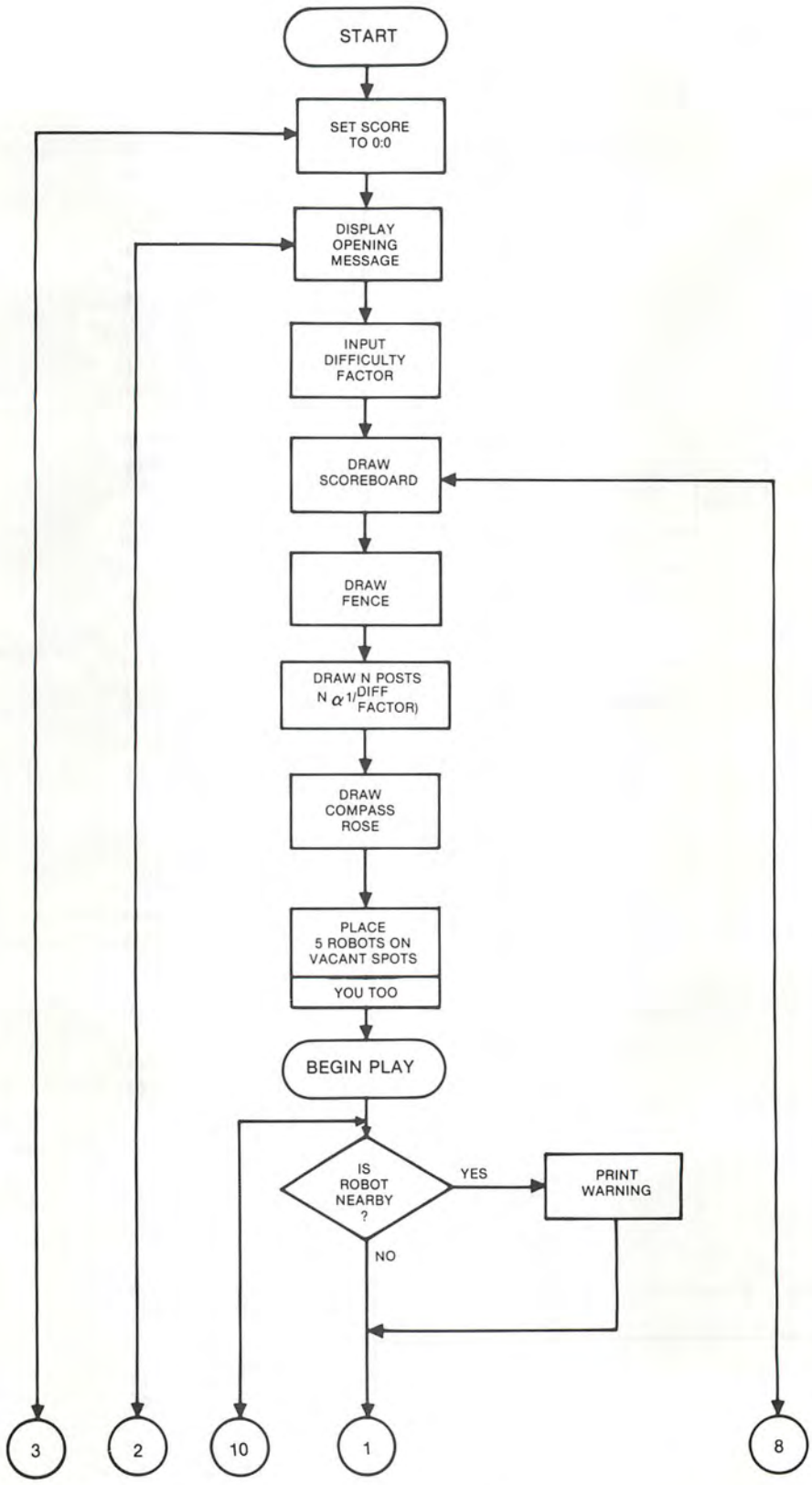

Figure 1. Flow Diagram

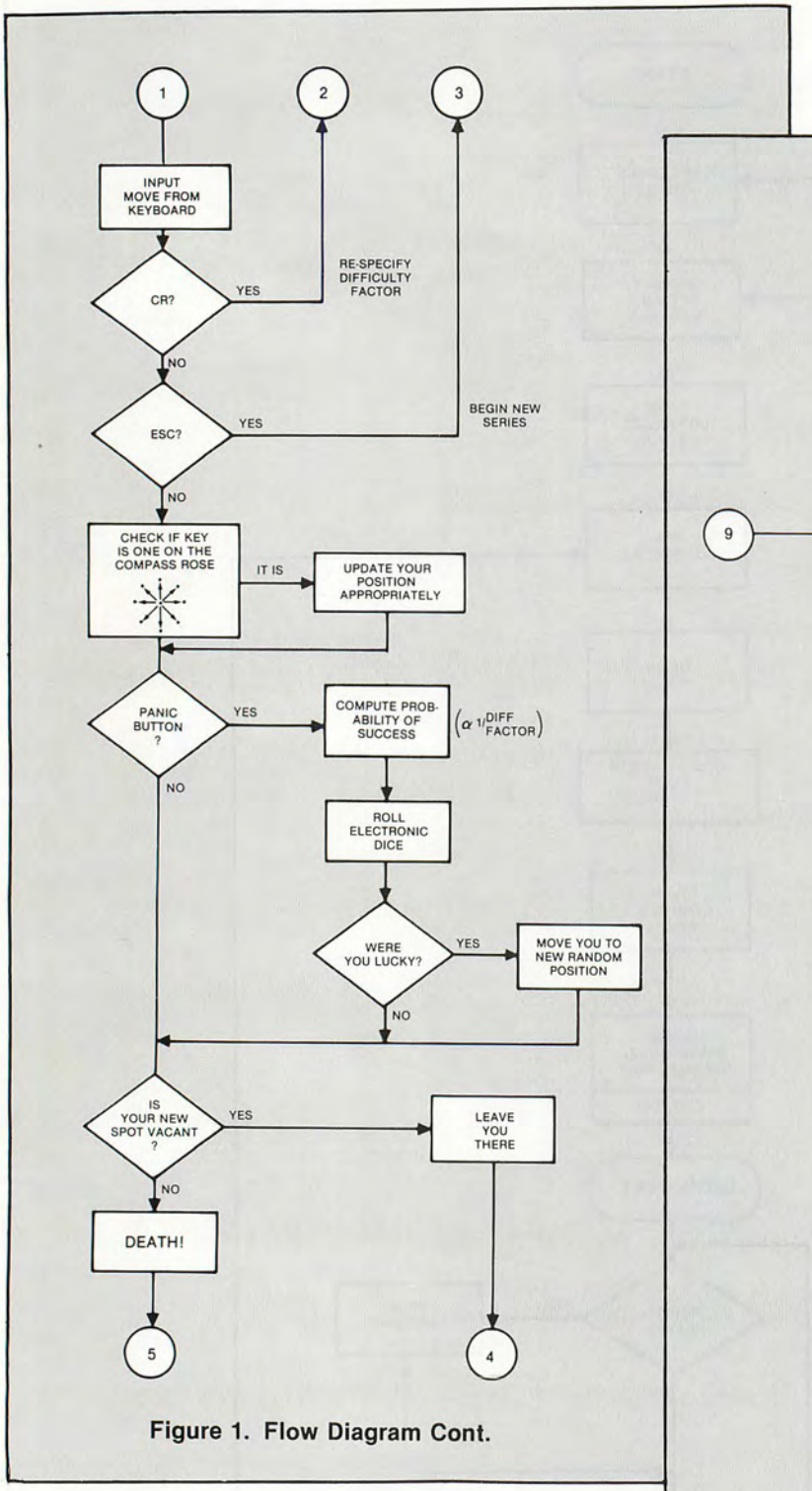

Figure 1. Flow Diagram Cont.

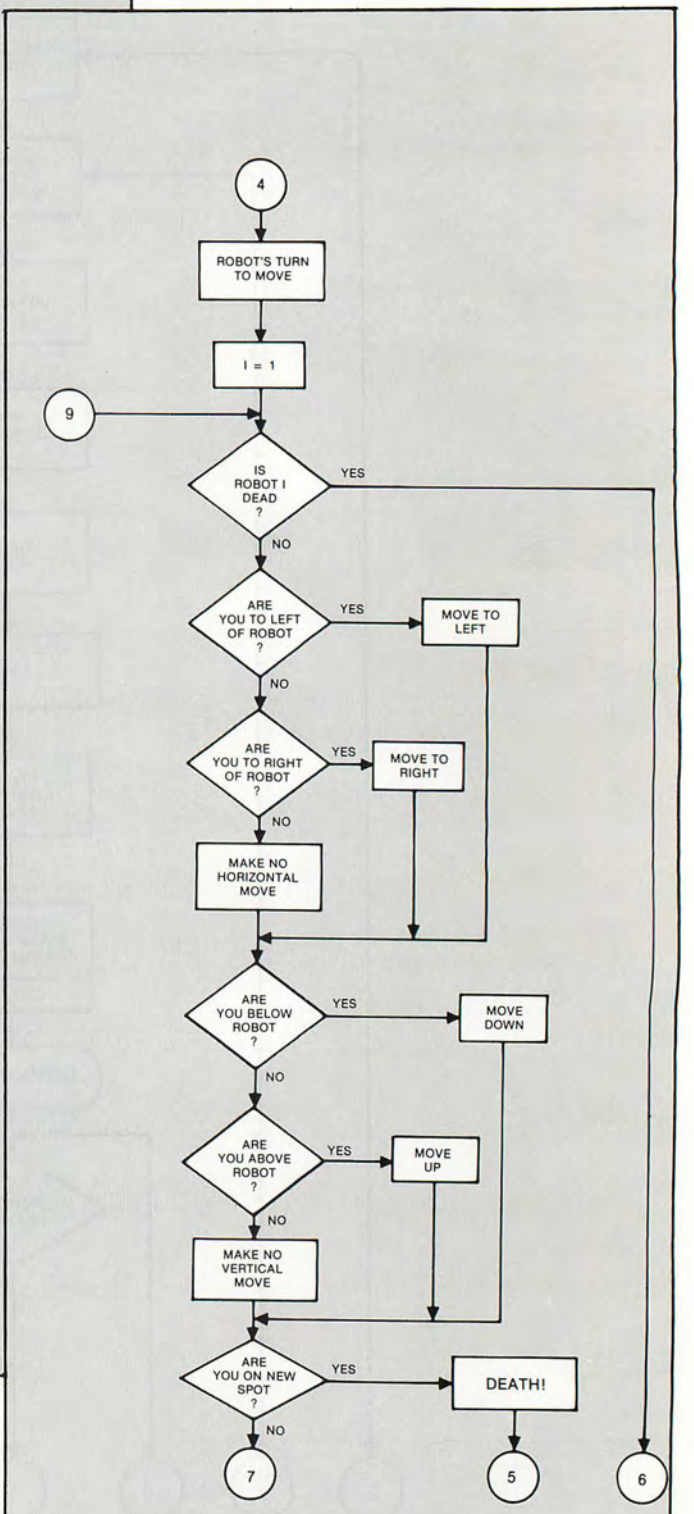

Figure 1. Cont.

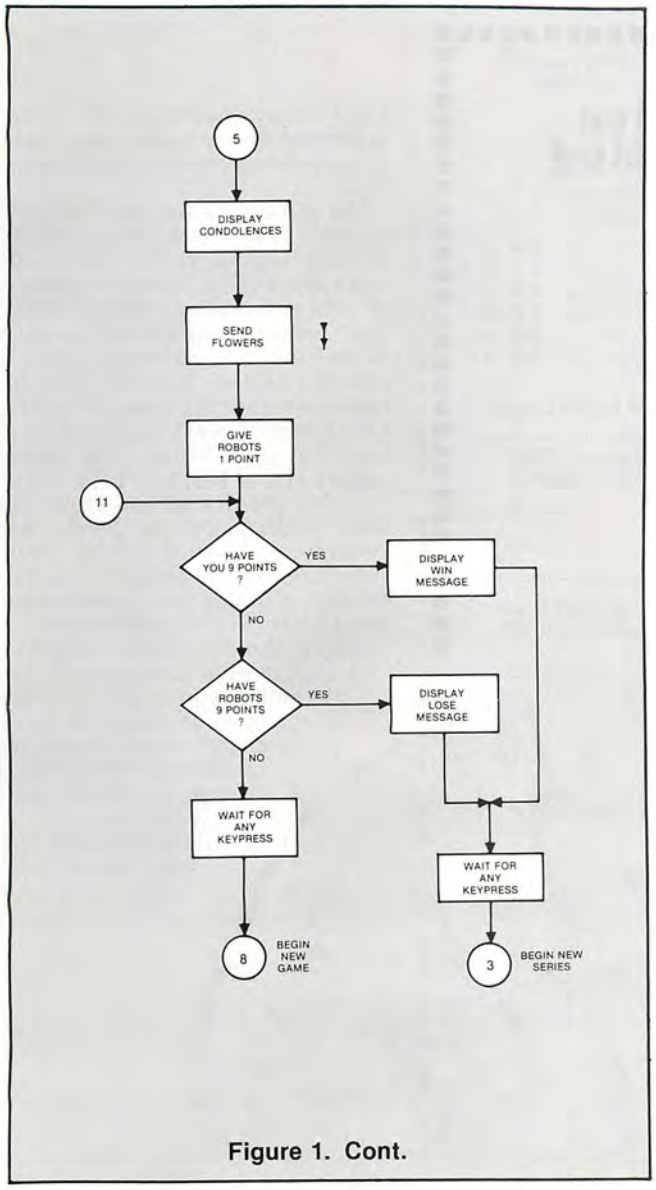

Figure 1. Cont.

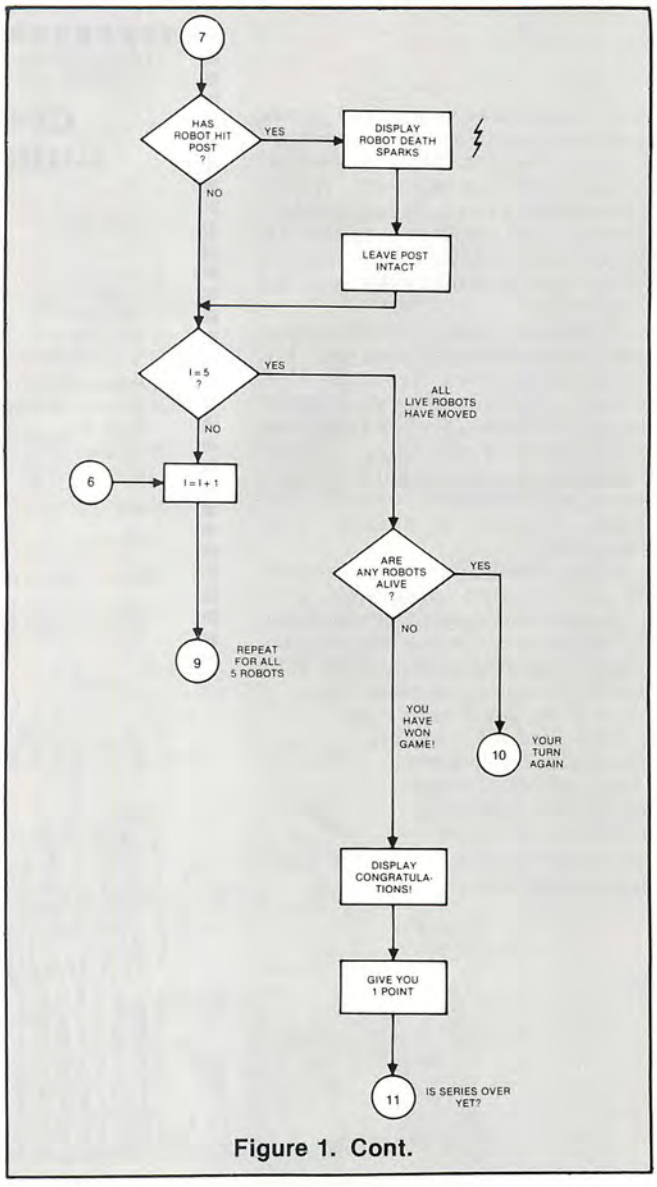

Figure 1. Cont.

ASSEMBLY LISTING

```
0000                    0000 *          * * * * * * * * * * * * * * * *
0000                    0010 *          *     THE GAME OF CHASE       *
0000                    0020 *          *       (VERSION 2.1)         *
0000                    0030 *          * * * * * * * * * * * * * * * *
0000                    0040 *
0000                    0050 *        WRITTEN BY JOSEPH JAY SANGER (4/5/77)
0000                    0060 *          IN 8080 ASSEMBLY LANGUAGE
0000                    0070 *            USING PROC. TECH. VDM
0000                    0080 *
0000                    0090 *
0000 AF                 0100 BEGIN  XRA   A           * STORE 0:0 SCORE
0001 32 E7 05           0110        STA   YSCORE      *   YOUR SCORE
0004 32 E6 05           0120        STA   RSCORE      *   ROBOT'S SCORE
0007 DB 01              0130 ENTER  IN    DATA        * RESET 3P+S
0009 31 50 06           0140        LXI   SP,STACK
000C CD 4E 04           0150        CALL  CLEAR       * CLEAR SCREEN
000F CD 92 04           0160        CALL  SCORE       * DRAW SCOREBOARD
0012                    0170 *
0012 21 10 CD           0180        LXI   H,MS2       * WRITE GAME HEADING
0015 01 E8 04           0190        LXI   B,MNAME
0018 CD D2 04           0200        CALL  MSGO
001B                    0210 *
001B 21 CC CF           0220 DIFF   LXI   H,MS1       * MORE HEADING
001E 01 C5 05           0230        LXI   B,MDIFF
0021 CD D2 04           0240        CALL  MSGO
0024 CD A9 01           0250        CALL  INP         * INPUT DIFFICULTY
0027 E6 0F              0260        ANI   0FH             FACTOR
0029 32 E5 05           0270        STA   DFST        * STORE IT
002C CD 4E 04           0280 START  CALL  CLEAR
002F CD 92 04           0290        CALL  SCORE
0032 16 00              0300        MVI   D,DCORN     * POINT TO UPPER LEFT
0034 1E 02              0310        MVI   E,ECORN       CORNER OF FIELD
0036 06 19              0320 TOP    MVI   B,WIDTH     * DRAW TOP
0038 CD 87 03           0330 T1     CALL  PLOT
003B 36 58              0340        MVI   M,'X'
003D 13                 0350        INX   D
003E CD 87 03           0360        CALL  PLOT
0041 36 20              0370        MVI   M,' '
0043 13                 0380        INX   D
0044 05                 0390        DCR   B
0045 C2 38 00           0400        JNZ   T1
0048 06 0D              0410 RSIDE  MVI   B,HEIGHT    * DRAW RIGHT SIDE
004A 1D                 0420        DCR   E
004B 1D                 0430        DCR   E
004C 14                 0440 R1     INR   D
004D CD 87 03           0450        CALL  PLOT
0050 36 58              0460        MVI   M,'X'
0052 05                 0470        DCR   B
0053 C2 4C 00           0480        JNZ   R1
0056 06 18              0490 BOTM   MVI   B,WIDTH-1 * DRAW BOTTOM
0058 1D                 0500 B1     DCR   E
0059 CD 87 03           0510        CALL  PLOT
005C 36 20              0520        MVI   M,' '
005E 1D                 0530        DCR   E
005F CD 87 03           0540        CALL  PLOT
0062 36 58              0550        MVI   M,'X'
0064 05                 0560        DCR   B
0065 C2 58 00           0570        JNZ   B1
0068 06 0D              0580 LSIDE  MVI   B,HEIGHT  * DRAW LEFT SIDE
006A 15                 0590 L1     DCR   D
006B CD 87 03           0600        CALL  PLOT
006E 36 58              0610        MVI   M,'X'
0070 05                 0620        DCR   B
0071 C2 6A 00           0630        JNZ   L1
0074                    0640 *
0074 3A E5 05           0650 SEED   LDA   DFST      * LAY ELECTRIC POSTS
0077 07                 0660        RLC                 (ACTUAL NO. DEPENDS
0078 47                 0670        MOV   B,A           ON DIFF. FACTOR)
0079 3E 1E              0680        MVI   A,1EH
007B 90                 0690        SUB   B
007C 47                 0700        MOV   B,A
007D CD BF 03           0710 LOOP1  CALL  RND
0080 E6 0F              0720        ANI   0FH
0082 57                 0730        MOV   D,A
0083 CD BF 03           0740        CALL  RND
0086 E6 7F              0750        ANI   7FH
0088 5F                 0760        MOV   E,A
0089 CD A9 03           0770        CALL  LIMIT
008C DA 7D 00           0780        JC    LOOP1
008F CD 87 03           0790        CALL  PLOT
0092 7D                 0800        MOV   A,L
0093 E6 FE              0810        ANI   0FEH
0095 6F                 0820        MOV   L,A
0096 36 58              0830        MVI   M,'X'
0098 05                 0840        DCR   B
0099 C2 7D 00           0850        JNZ   LOOP1
009C                    0860 *
009C 21 F6 CC           0870 ROSE   LXI   H,RCORN    * PRINT COMPASS ROSE
009F 36 54              0880        MVI   M,'T'
00A1 21 FA CC           0890        LXI   H,RCORN+4
00A4 36 59              0900        MVI   M,'Y'
```

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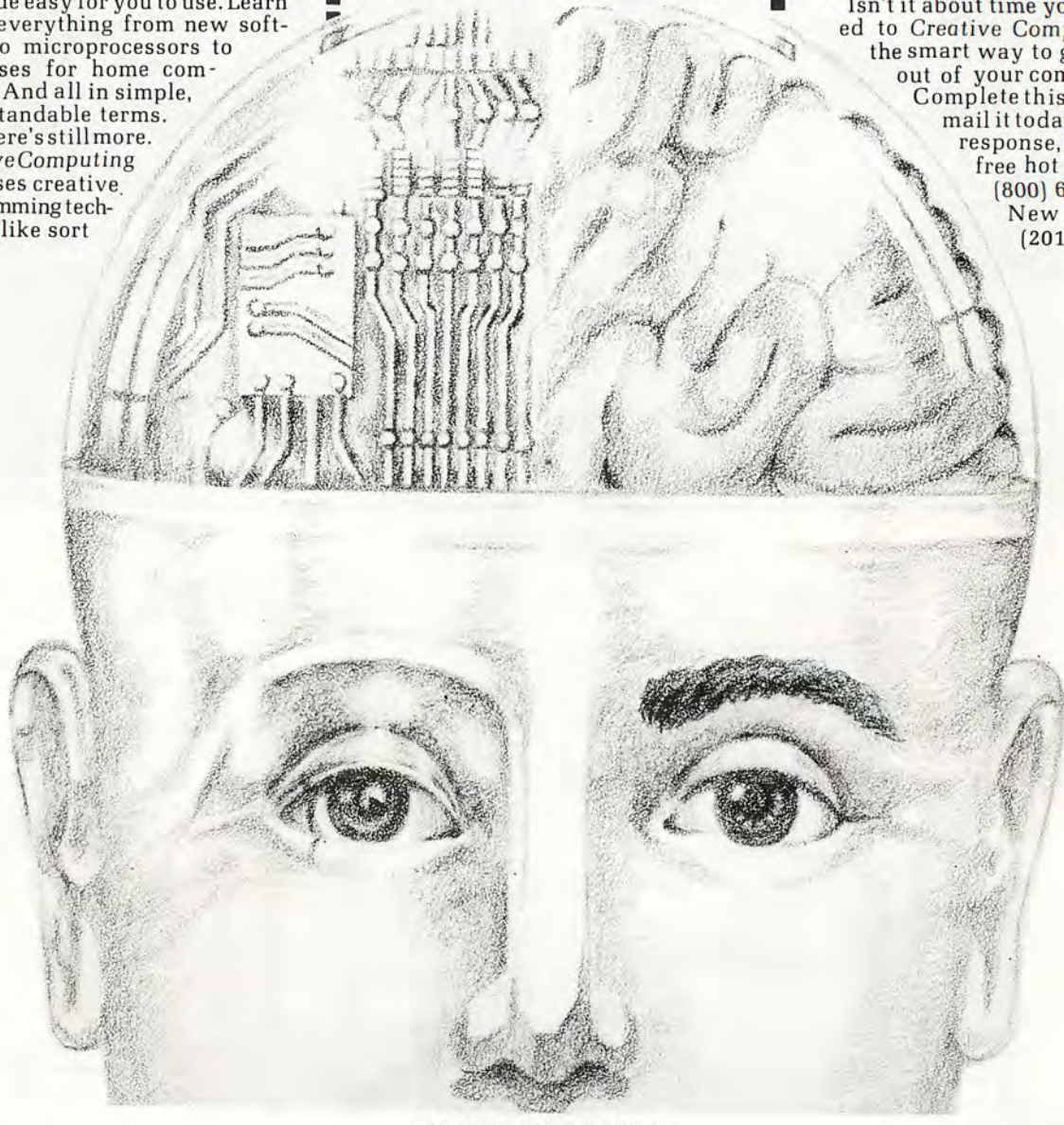

CIRCLE INQUIRY NO. 4

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00A9 36 55
00AB 21 38 CD
00AE 36 5C
00B0 21 3A CD
00B3 36 5E
00B5 21 3C CD
00B8 36 2F
00BA 21 76 CD
00BD 36 47
00BF 21 78 CD
00C2 36 0D
00C4 21 7A CD
00C7 36 4B
00C9 21 7C CD
00CC 36 09
00CE 21 7E CD
00D1 36 4A
00D3 21 B8 CD
00D6 36 2F
00D8 21 BA CD
00DB 36 08
00DD 21 BC CD
00E0 36 5C
00E2 21 F6 CD
00E5 36 42
00E7 21 FA CD
00EA 36 4E
00EC 21 FE CD
00EF 36 4D
00F1
00F1 CD 15 01
00F4 22 EA 05
00F7 CD 15 01
00FA 22 EC 05
00FD CD 15 01
0100 22 EE 05
0103 CD 15 01
0106 22 F0 05
0109 CD 15 01
010C 22 F2 05
010F CD 37 01
0112 C3 58 01
0115 CD BF 03
0118 E6 0F
011A 57
011B CD BF 03
011E E6 FE
0120 5F
0121 CD A9 03
0124 DA 15 01
0127 CD B7 03
012A 7E
012B FE 20
012D C2 15 01
0130 36 07
0132 05
0133 C0
0134 C3 58 01
0137
0137 CD BF 03
013A E6 0F
013C 57
013D CD BF 03
0140 E6 FE
0142 5F
0143 CD A9 03
0146 DA 37 01
0149 CD B7 03
014C 7E
014D FE 20
014F C2 37 01
0152 36 0F
0154 22 E8 05
0157 C9
0158
0158 CD 0C 04
015B CD A9 01
015E 2A E8 05
0161 36 20
0163 FE 4A
0165 CC 6C 03
0168 FE 55
016A CC 6F 03
016D FE 59
016F CC 5F 03
0172 FE 54
0174 CC 75 03
0177 FE 47
0179 CC 69 03
017C FE 42
017E CC 7B 03
0181 FE 4E
0183 CC 64 03
0186 FE 4D
0188 CC B1 03
018B FE 50
018D CC 9D 02
0190 FE 48
0192 CA 9B 01
0195 7E
0196 FE 20
0198 C2 B5 02
019B 36 0F
019D 22 E8 05
01A0 CD BF 01
01A3 CD E6 03
01A6 C3 58 01
01A9
01A9 DB 00
01AB E6 40
01AD CA A9 01
01B0 DB 01
01B2 E6 7F
01B4 FE 0D
01B6 CA 07 00
01B9 FE 1B
01BB CA 00 00
01BE C9
01BF
01BF 2A EA 05
01C2 CD 09 02
01C5 DA CE 01
01C8 CD 38 02
01CB 22 EA 05
01CE 2A EC 05
01D1 CD 09 02
01D4 DA DD 01
01D7 CD 38 02
01DA 22 EC 05
01DD 2A EE 05
01E0 CD 09 02
01E3 DA EC 01
01E6 CD 38 02
01E9 22 EE 05
01EC 2A F0 05
01EF CD 09 02
01F2 DA FB 01
01F5 CD 38 02
01F8 22 F0 05
01FB 2A F2 05
01FE CD 09 02
0201 DB
0202 CD 38 02
0205 22 F2 05
0208 C9
0209
0209 7E
0910          LXI   H,RCORN+8
0920          MVI   M,'U'
0930          LXI   H,RCORN+42H
0940          MVI   M,5CH
0950          LXI   H,RCORN+44H
0960          MVI   M,5EH
0970          LXI   H,RCORN+46H
0980          MVI   M,2FH
0990          LXI   H,RCORN+80H
1000          MVI   M,'G'
1010          LXI   H,RCORN+82H
1020          MVI   M,0DH
1030          LXI   H,RCORN+84H
1040          MVI   M,'H'
1050          LXI   H,RCORN+86H
1060          MVI   M,09H
1070          LXI   H,RCORN+88H
1080          MVI   M,'J'
1090          LXI   H,RCORN+0C2H
1100          MVI   M,2FH
1110          LXI   H,RCORN+0C4H
1120          MVI   M,0BH
1130          LXI   H,RCORN+0C6H
1140          MVI   M,5CH
1150          LXI   H,RCORN+100H
1160          MVI   M,'B'
1170          LXI   H,RCORN+104H
1180          MVI   M,'N'
1190          LXI   H,RCORN+108H
1200          MVI   M,'M'
1210 *                        # INTITIAL ROBOT PLACEMENT
1220 ROBOT    CALL  SEL       # SELECT A RANDOM SPOT
1230          SHLD  ROB1      # STORE ROBOT#1'S POSITION
1240          CALL  SEL       # ETC...
1250          SHLD  ROB2
1260          CALL  SEL
1270          SHLD  ROB3
1280          CALL  SEL
1290          SHLD  ROB4
1300          CALL  SEL
1310          SHLD  ROB5
1320          CALL  YOU       # DO SAME FOR YOU
1330          JMP   YMOVE
1340 SEL      CALL  RND       # GET RND NUMBER
1350          ANI   0FH       # STRIP OFF 4 MSB'S
1360          MOV   D,A
1370          CALL  RND
1380          ANI   0FEH      # STRIP OF MSB
1390          MOV   E,A
1400          CALL  LIMIT     # IS DE POINTING TO VALID
1410          JC    SEL         POINT ON FIELD?
1420          CALL  PLOT
1430          MOV   A,M       # IS SPOT VACANT
1440          CPI   ' '
1450          JNZ   SEL       # IF NOT, REPEAT
1460          MVI   M,7       # IF SO, PUT ROBOT IN
1470          DCR   B
1480          RNZ
1490          JMP   YMOVE
1500 *
1510 YOU      CALL  RND       # YOUR INITIAL POSITION
1520          ANI   0FH       # STRIP OF 4 MSB'S
1530          MOV   D,A
1540          CALL  RND
1550          ANI   0FEH      # STRIP OF MSB
1560          MOV   E,A
1570          CALL  LIMIT     # IS IT A VALID POINT?
1580          JC    YOU       # IF NOT, REPEAT
1590          CALL  PLOT
1600          MOV   A,M
1610          CPI   ' '       # IS IT VACANT?
1620          JNZ   YOU       # REPEAT IF NOT
1630          MVI   M,0FH     # PUT YOU ON MAP
1640          SHLD  YOUP      # STORE YOUR CURRENT POS.
1650          RET
1660 *
1670 YMOVE    CALL  NEAR      # IS A ROBOT ADJACENT?
1680 YMOV1    CALL  INP       # GET KBD INPU
1690          LHLD  YOUP      # GET YOUR CURRENT POS
1700          MVI   M,' '     # LIFT YOU OFF MAP
1710          CPI   'J'       # IS 'J' PRESSED?
1720          CZ    RT        # MOVE RIGHT IF SO
1730          CPI   'U'       # ETC...
1740          CZ    UR                (UR = UPPER RIGHT
1750          CPI   'Y'                 LL = LOWER LEFT
1760          CZ    UP                  ETC...
1770          CPI   'T'
1780          CZ    UL
1790          CPI   'G'
1800          CZ    LF
1810          CPI   'B'
1820          CZ    LL
1830          CPI   'N'
1840          CZ    DN
1850          CPI   'M'
1860          CZ    LR
1870          CPI   'P'       # IS PANIC BUTTON PUSHED?
1880          CZ    PANIC     #   CALL PANIC IF SO
1890          CPI   'H'
1900          JZ    Y1
1910          MOV   A,M       # IS NEW SPOT VACANT?
1920          CPI   ' '
1930          JNZ   DEATH     # IF NOT, YOU ARE DEAD
1940 Y1       MVI   M,0FH     # IF SO, PUT YOU THERE
1950          SHLD  YOUP      # AND STORE NEW POS.
1960          CALL  RMOVE     # ROBOT'S TURN TO MOVE
1970          CALL  END       # IS SERIES OVER?
1980          JMP   YMOVE     # AND AGAIN...
1990 *
2000 INP      IN    STAT      # KBD SERVICE ROUTINE
2010          ANI   RDA
2020          JZ    INP
2030          IN    DATA
2040          ANI   7FH
2050          CPI   0DH       # CARRIAGE RETURN
2060          JZ    ENTER       RESTARTS GAME
2070          CPI   1BH       # 'ESC'
2080          JZ    BEGIN       RESTARTS SERIES
2090          RET
2100 *                        # ROBOT'S TURN
2110 RMOVE    LHLD  ROB1      # GET CURRENT POS
2120          CALL  RDEAD     # IS THIS ROBOT DEAD?
2130          JC    RMOV1     # IF SO, SKIP
2140          CALL  SEEK      # IF NOT,MOVE ROBOT
2150          SHLD  ROB1      # STORE NEW POS.
2160 RMOV1    LHLD  ROB2      # ETC...
2170          CALL  RDEAD
2180          JC    RMOV2
2190          CALL  SEEK
2200          SHLD  ROB2
2210 RMOV2    LHLD  ROB3
2220          CALL  RDEAD
2230          JC    RMOV3
2240          CALL  SEEK
2250          SHLD  ROB3
2260 RMOV3    LHLD  ROB4
2270          CALL  RDEAD
2280          JC    RMOV4
2290          CALL  SEEK
2300          SHLD  ROB4
2310 RMOV4    LHLD  ROB5
2320          CALL  RDEAD
2330          RC
2340          CALL  SEEK
2350          SHLD  ROB5
2360          RET
2370 *
2380 RDEAD    MOV   A,M       # IF 'X' ON ROBOT'S SPOT,
020A FE 58
020C 37
020D C8
020E 3F
020F C9
0210
0210 7E
0211 FE 0F
0213 CA B5 02
0216 FE 58
0218 CA 1E 02
021B 36 07
021D C9
021E 16 A0
0220 36 04
0222 1E FF
0224 1D
0225 C2 24 02
0228 1E FF
022A 36 84
022C 1D
022D C2 2C 02
0230 15
0231 C2 20 02
0234 36 58
0236 AF
0237 C9
0238
0238 3A 20
023A E5
023B CD 71 02
023E E1
023F CD 7E 02
0242 E5
0243 CD 4D 02
0246 E1
0247 CD 5E 02
024A C3 10 02
024D
024D 7D
024E E6 C0
0250 6F
0251 EB
0252 2A E8 05
0255 7D
0256 E6 C0
0258 93
0259 4F
025A 7C
025B 9A
025C 47
025D C9
025E
025E 07
025F DA 5F 03
0262 79
0263 0F
0264 DA 5F 03
0267 AF
0268 B0
0269 C2 64 03
026C B1
026D C2 64 03
0270 C9
0271
0271 7D
0272 E6 3F
0274 6F
0275 EB
0276 2A E8 05
0279 7D
027A E6 3F
027C 93
027D C9
027E
027E C8
027F F2 6C 03
0282 C3 69 03
0285
0285 36 0C
0287 CD 6C 04
028A 3A E6 05
028D 3C
028E 32 E6 05
0291 CD 92 04
0294 CD 01 03
0297 CD F7 02
029A C3 2C 00
029D
029D F5
029E 3A E5 05
02A1 FE 09
02A3 C2 C8 02
02A6 0E 07
02A8 CD BF 03
02AB A1
02AC FE 01
02AE CA B4 02
02B1 C3 ED 02
02B4 E5
02B5 2A EA 05
02B8 36 07
02BA 2A EC 05
02BD 36 07
02BF 2A EE 05
02C2 36 07
02C4 E1
02C5 C3 EF 02
02C8 3A E5 05
02CB DE 03
02CD F2 D5 02
02D0 0E 01
02D2 C3 E4 02
02D5 3A E5 05
02D8 DE 06
02DA 0E 03
02DC F2 E2 02
02DF C3 E4 02
02E2 0E 07
02E4 CD BF 03
02E7 A1
02E8 FE 01
02EA CA EF 02
02ED F1
02EE C9
02EF CD 37 01
02F2 F1
02F3 E1
02F4 C3 58 01
02F7
02F7 DB 00
02F9 E6 40
02FB CA F7 02
02FE DB 01
0300 C9
0301
0301 3A E6 05
0304 FE 09
0306 CA 31 03
0309 3A E7 05
030C FE 09
030E C0
030F CD F7 02
0312 CD 4E 04
0315 21 10 CD
0318 01 BB 05
031B CD D2 04
031E 3A E7 05
2390          CPI   'X'     # THEN HE IS DEAD; RET.
2400          STC           # WITH CARRY SET
2410          RZ
2420          CMC
2430          RET
2440 *
2450 CHEK     MOV   A,M     # CHECK IF ROBOTS BUMPED ANYONE
2460          CPI   0FH     #   AND MAKE APPROPRIATE MOVE
2470          JZ    DEATH   # YOU DIE IF HE BUMPS YOU
2480          CPI   'X'     # HE DIES IF HE BUMPS 'X'
2490          JZ    FLASH
2500          MVI   M,7     # OTHERWISE HE LIVES
2510          RET
2520 FLASH    MVI   D,0A0H # ROBOT'S DEATH DANCE
2530 FLAS1    MVI   M,4
2540          MVI   E,0FFH
2550 FLAS2    DCR   E
2560          JNZ   FLAS2
2570          MVI   E,0FFH
2580          MVI   M,84H
2590 FLAS3    DCR   E
2600          JNZ   FLAS3
2610          DCR   D
2620          JNZ   FLAS1
2630          MVI   M,'X'
2640          XRA   A
2650          RET
2660 *
2670 SEEK     MVI   M,' '     # LIFT ROBOT FROM MAP
2680          PUSH  H
2690          CALL  SUBH    # FIND HORIZ. DIRECTION
2700          POP   H
2710          CALL  DECH    # MOVE IN APPROPRIATE DIR.
2720          PUSH  H
2730          CALL  SUBV    # FIND VERT. DIR.
2740          POP   H
2750          CALL  DECV    # AND MOVE IN IT
2760          JMP   CHEK
2770 *
2780 SUBV     MOV   A,L     # ENTER WITH ROBOT'S POS.
2790          ANI   0C0H        IN HL
2800          MOV   L,A     # STRIP OF HORIZ. INFORM.
2810          XCHG
2820          LHLD  YOUP    # YOUR POS. IN DE
2830          MOV   A,L
2840          ANI   0C0H    # STRIP OFF HORIZ. INFORM.
2850          SUB   E       # FIND DIFFERENCE
2860          MOV   C,A
2870          MOV   A,H
2880          SBB   D
2890          MOV   B,A
2900          RET
2910 *
2920 DECV     RLC           # MOVE UP IF NEC.
2930          JC    UP
2940          MOV   A,C
2950          RRC
2960          JC    UP
2970          XRA   A
2980          ADD   B
2990          JNZ   DN      # MOVE DOWN IF NEC.
3000          ADD   C
3010          JNZ   DN
3020          RET             # OR STAY ON THIS ROW
3030 *
3040 SUBH     MOV   A,L     # ROBOT'S HORIZ. POS IN L
3050          ANI   3FH     # STRIP OFF VERT. INFORM.
3060          MOV   L,A
3070          XCHG
3080          LHLD  YOUP    # YOUR HORIZ. POS IN L
3090          MOV   A,L
3100          ANI   3FH     # STRIP OFF VERT. INFORM.
3110          SUB   E       # FIND DIFF.
3120          RET
3130 *
3140 DECH     RZ            # STAY IN COLUMN IF NEC.
3150          JP    RT      # OR MOVE RIGHT
3160          JMP   LF      # OR LEFT
3170 *
3180 DEATH    MVI   M,0CH   # PUT FLOWERS ON SPOT
3190          CALL  MSG2    # PUT NOTICE ON SCREEN
3200          LDA   RSCORE  # GIVE ROBOT'S A POINT
3210          INR   A
3220          STA   RSCORE
3230          CALL  SCORE   # PUT NEW SCORE UP
3240          CALL  OVER    # IS SERIES OVER?
3250          CALL  WAIT    # WAIT FOR KP
3260          JMP   START   # NEW GAME
3270 *
3280 PANIC    PUSH  PSW
3290          LDA   DFST    #  'P' PRESS WILL LIFT YOU
3300          CPI   9         OFF TO NEW RND POS.WITH
3310          JNZ   PAN3      PROBABILITY DEPENDENT
3320          MVI   C,7       ON DIFF. FACTOR
3330          CALL  RND
3340          ANA   C
3350          CPI   1
3360          JZ    PAN5
3370          JMP   PAN4
3380 PAN5     PUSH  H       # LEVEL 9 PENALTY:  SOME
3390          LHLD  ROB1      ROBOTS MAY REGENERATE
3400          MVI   M,7
3410          LHLD  ROB2
3420          MVI   M,7
3430          LHLD  ROB3
3440          MVI   M,7
3450          POP   H
3460          JMP   PANN
3470 PAN3     LDA   DFST
3480          SBI   3
3490          JP    PAN1
3500          MVI   C,1
3510          JMP   PANOK
3520 PAN1     LDA   DFST
3530          SBI   6
3540          MVI   C,3
3550          JP    PAN2
3560          JMP   PANOK
3570 PAN2     MVI   C,7
3580 PANOK    CALL  RND
3590          ANA   C
3600          CPI   1
3610          JZ    PANN
3620 PAN4     POP   PSW
3630          RET
3640 PANN     CALL  YOU
3650          POP   PSW
3660          POP   PSW
3670          JMP   YMOVE
3680 *
3690 WAIT     IN    STAT    # PAUSE
3700          ANI   RDA
3710          JZ    WAIT
3720          IN    DATA
3730          RET
3740 *
3750 OVER     LDA   RSCORE  # DOES ROBOT HAVE 9 ?
3760          CPI   09H
3770          JZ    END1
3780 OVER1    LDA   YSCORE  # DO YOU?
3790          CPI   09H
3800          RNZ
3810 ENDGAME  CALL  WAIT    # PAUSE
3820          CALL  CLEAR   # CLEAR SCREEN
3830          LXI   H,ENDM1 # DISPLAY YOUR 'U'
3840          LXI   B,ENDB2     MESSAGE
3850          CALL  MSGD
3860          LDA   YSCORE  # AND FINAL SCI
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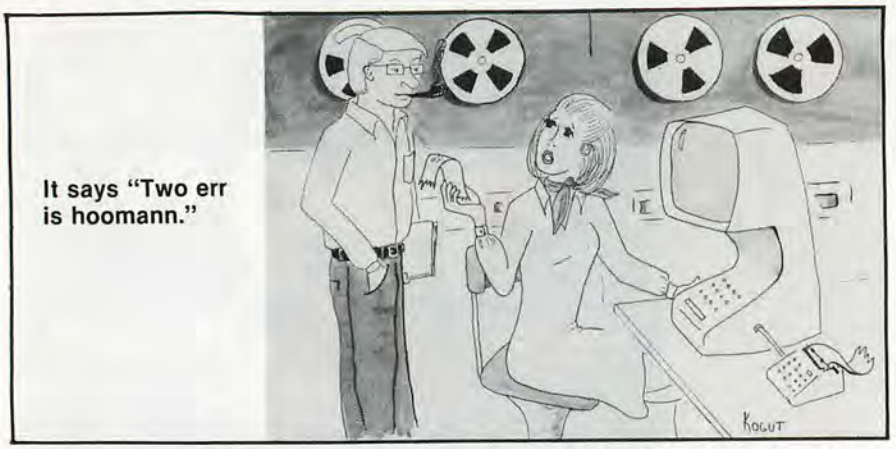
0321 C6 30          3870          ADI   30H           SERIES
0323 32 27 CD       3880          STA   OCD27H
0326 3A E6 05       3890          LDA   RSCORE
0329 C6 30          3900          ADI   30H
032B 32 29 CD       3910          STA   OCD29H
032E C3 50 03       3920          JMP   END2
0331 CD F7 02       3930 END1     CALL  WAIT          * PAUSE
0334 CD 4E 04       3940          CALL  CLEAR         * CLEAR SCREEN
0337 21 10 CD       3950          LXI   H,ENDM1       * DISPLAY ROBOT'S WIN
033A 01 70 05       3960          LXI   B,ENDB1             MESSAGE
033D CD D2 04       3970          CALL  MSGO
0340 3A E6 05       3980          LDA   RSCORE        * AND THE SCORE
0343 C6 30          3990          ADI   30H
0345 32 27 CD       4000          STA   OCD27H
0348 3A E7 05       4010          LDA   YSCORE
034B C6 30          4020          ADI   30H
034D 32 29 CD       4030          STA   OCD29H
0350 21 90 CD       4040 END2     LXI   H,ENDM3
0353 01 A6 05       4050          LXI   B,ENDB3
0356 CD D2 04       4060          CALL  MSGO
0359 CD F7 02       4070 END3     CALL  WAIT          * PAUSE
035C C3 00 00       4080          JMP   BEGIN         * NEW SERIES
035F                4090 *
035F 11 C0 FF       4100 UP       LXI   D,0FFC0H      * MOVEMENT ROUTINES
0362 19             4110          DAD   D                (8 DIRECTIONS)
0363 C9             4120          RET
0364 11 40 00       4130 DN       LXI   D,40H
0367 19             4140          DAD   D
0368 C9             4150          RET
0369 2B             4160 LF       DCX   H
036A 2B             4170          DCX   H
036B C9             4180          RET
036C 23             4190 RT       INX   H             * NOTE: ONE UNIT TO RIGHT
036D 23             4200          INX   H                    IS ACTUALLY TWO VDM
036E C9             4210          RET                        BOXES
036F CD 5F 03       4220 UR       CALL  UP
0372 C3 6C 03       4230          JMP   RT
0375 CD 5F 03       4240 UL       CALL  UP
0378 C3 69 03       4250          JMP   LF
037B CD 64 03       4260 LL       CALL  DN
037E C3 69 03       4270          JMP   LF
0381 CD 64 03       4280 LR       CALL  DN
0384 C3 6C 03       4290          JMP   RT
0387                4300 *
0387 21 00 CC       4310 PLOT     LXI   H,0CC00H      * ENTER WITH D,E SPECIFY-
038A C5             4320          PUSH  B                ING COORD; RETRUNS WITH
038B 7A             4330 VERT     MOV   A,D              H,L POINING TO CORRESP-
038C E6 0F          4340          ANI   0FH              ONDING MEM. LOC ON VDM
038E 06 40          4350 LP1      MVI   B,40H
0390 CA 9C 03       4360 LP2      JZ    HORIZ
0393 23             4370          INX   H
0394 05             4380          DCR   B
0395 C2 90 03       4390          JNZ   LP2
0398 3D             4400          DCR   A
0399 C2 8E 03       4410          JNZ   LP1
039C 7B             4420 HORIZ    MOV   A,E
039D E6 7F          4430          ANI   7FH
039F CA A7 03       4440 LP3      JZ    DONE
03A2 23             4450          INX   H
03A3 3D             4460          DCR   A
03A4 C3 9F 03       4470          JMP   LP3
03A7 C1             4480 DONE     POP   B
03A8 C9             4490          RET
03A9                4500 *
03A9 7A             4510 LIMIT    MOV   A,D          * RETURNS WITH CARRY RESET
03AA DE 01          4520          SBI   LOWD           IF D,E POINTING TO VALID
03AC 37             4530          STC                  POINT (ON FIELD)
03AD F8             4540          RM
03AE 7A             4550          MOV   A,D
03AF DE 0C          4560          SBI   HID
03B1 37             4570          STC
03B2 F0             4580          RP
03B3 7B             4590          MOV   A,E
03B4 DE 03          4600          SBI   LOWE
03B6 37             4610          STC
03B7 F8             4620          RM
03B8 7B             4630          MOV   A,E
03B9 DE 31          4640          SBI   HIE
03BB 37             4650          STC
03BC F0             4660          RP
03BD 3F             4670          CMC
03BE C9             4680          RET
03BF                4690 *
03BF C5             4700 RND      PUSH  B          * RANDOM NUMBER GEN.
03C0 E5             4710          PUSH  H            RETURNS WITH NUMBER
03C1 21 E4 05       4720          LXI   H,SH+3       IN A REGISTER
03C4 06 08          4730          MVI   B,8
03C6 7E             4740          MOV   A,M          (FROM D.B.J.C.C.&.O.)
03C7 07             4750 RTOP     RLC
03C8 07             4760          RLC
03C9 07             4770          RLC
03CA AE             4780          XRA   M
03CB 17             4790          RAL
03CC 17             4800          RAL
03CD 2D             4810          DCR   L
03CE 2D             4820          DCR   L
03CF 2D             4830          DCR   L
03D0 7E             4840          MOV   A,M
03D1 17             4850          RAL
03D2 77             4860          MOV   M,A
03D3 2C             4870          INR   L
03D4 7E             4880          MOV   A,M
03D5 17             4890          RAL
03D6 77             4900          MOV   M,A
03D7 2C             4910          INR   L
03D8 7E             4920          MOV   A,M
03D9 17             4930          RAL
03DA 77             4940          MOV   M,A
03DB 2C             4950          INR   L
03DC 7E             4960          MOV   A,M
03DD 17             4970          RAL
03DE 77             4980          MOV   M,A
03DF 05             4990          DCR   B
03E0 C2 C7 03       5000          JNZ   RTOP
03E3 E1             5010          POP   H
03E4 C1             5020          POP   B
03E5 C9             5030          RET
03E6                5040 *
03E6 2A EA 05       5050 END      LHLD  ROB1       * ARE ANY ROBOT'S ALIVE
03E9 7E             5060          MOV   A,M
03EA FE 07          5070          CPI   7
03EC C8             5080          RZ
03ED 2A EC 05       5090          LHLD  ROB2
03F0 7E             5100          MOV   A,M
03F1 FE 07          5110          CPI   7
03F3 C8             5120          RZ
03F4 2A EE 05       5130          LHLD  ROB3
03F7 7E             5140          MOV   A,M
03F8 FE 07          5150          CPI   7
03FA C8             5160          RZ
03FB 2A F0 05       5170          LHLD  ROB4
03FE 7E             5180          MOV   A,M
03FF FE 07          5190          CPI   7
0401 C8             5200          RZ
0402 2A F2 05       5210          LHLD  ROB5
0405 7E             5220          MOV   A,M
0406 FE 07          5230          CPI   7
0408 C8             5240          RZ
0409 C3 76 04       5250          JMP   WIN
040C                5260 *
040C 2A EB 05       5270 NEAR     LHLD  YOUP       * ARE AY ROBOT'S NEARBY
040F CD 6C 03       5280          CALL  RT
0412 CD 43 04       5290          CALL  NEAR2
0415 CD 5F 03       5300          CALL  UP
0418 CD 43 04       5310          CALL  NEAR2
041B CD 69 03       5320          CALL  LF
041E CD 43 04       5330          CALL  NEAR2
0421 CD 69 03       5340          CALL  LF
0424 CD 43 04       5350          CALL  NEAR2
0427 CD 64 03       5360          CALL  DN
042A CD 43 04       5370          CALL  NEAR2
042D CD 64 03       5380          CALL  DN
0430 CD 43 04       5390          CALL  NEAR2
0433 CD 6C 03       5400          CALL  RT
0436 CD 43 04       5410          CALL  NEAR2
0439 CD 6C 03       5420          CALL  RT
043C CD 43 04       5430          CALL  NEAR2
043F CD C1 04       5440          CALL  MCLEAR
0442 C9             5450 NEAR3    RET
0443                5460 *
0443 7E             5470 NEAR2    MOV   A,M        * LOOK FOR ROBOT SYMBOL
0444 FE 07          5480          CPI   7
0446 C0             5490          RNZ
0447 CD 5E 04       5500          CALL  MSG1       * INFORM YOU OF ROBOT'S
044A E1             5510          POP   H                PROXIMITY
044B C3 42 04       5520          JMP   NEAR3
044E                5530 *
044E 21 00 CC       5540 CLEAR    LXI   H,0CC00H * CLEAR AND INITIALIZE
0451 36 20          5550          MVI   M,' '      *     THE VDM SCREEN
0453 23             5560          INX   H
0454 7C             5570          MOV   A,H
0455 FE D0          5580          CPI   0D0H
0457 C2 51 04       5590          JNZ   CLEAR+3
045A AF             5600          XRA   A
045B D3 C8          5610          OUT   0C8H
045D C9             5620          RET
045E                5630 *
045E E5             5640 MSG1     PUSH  H        * PUT MESSAGE ON SCREEN
045F C5             5650          PUSH  B
0460 21 CC CF       5660          LXI   H,MS1
0463 01 04 05       5670          LXI   B,M1
0466 CD DC 04       5680          CALL  MSGO
0469 C1             5690          POP   B
046A E1             5700          POP   H
046B C9             5710          RET
046C                5720 *
046C 21 CC CF       5730 MSG2     LXI   H,MS1    * PUT ANOTHER ONE UP
046F 01 1C 05       5740          LXI   B,M2
0472 CD DC 04       5750          CALL  MSGO
0475 C9             5760          RET
0476                5770 *
0476 21 CC CF       5780 WIN      LXI   H,MS1    * PUT WIN MESSAGE UP
0479 01 37 05       5790          LXI   B,MWIN
047C CD DC 04       5800          CALL  MSGO
047F 3A E7 05       5810          LDA   YSCORE   * GIVE YOU A POINT
0482 3C             5820          INR   A
0483 32 E7 05       5830          STA   YSCORE
0486 CD 92 04       5840          CALL  SCORE    * DISPLAY NEW SCORE
0489 CD 01 03       5850          CALL  OVER     * IS GAME OVER?
048C CD F7 02       5860          CALL  WAIT     * PAUSE
048F C3 2C 00       5870          JMP   START    * NEW GAME
0492                5880 *
0492 21 77 CF       5890 SCORE    LXI   H,SRE    * DRAW SCOREBOARD
0495 01 59 05       5900          LXI   B,MSR    BEGINNING AT LOC,
0498 CD D2 04       5910          CALL  MSGO     'SRE'
049B 3A E7 05       5920          LDA   YSCORE   * GET YOUR SCORE
049E C6 30          5930          ADI   30H      * CONVERT TO ASCII
04A0 21 BD CF       5940          LXI   H,SCR
04A3 77             5950          MOV   M,A
04A4 3A E6 05       5960          LDA   RSCORE   * AND THEIR'S
04A7 C6 30          5970          ADI   30H
04A9 11 40 00       5980          LXI   D,40H
04AC 19             5990          DAD   D
04AD 77             6000          MOV   M,A
04AE 21 B8 CF       6010          LXI   H,MSY
04B1 01 63 05       6020          LXI   B,MSR1
04B4 CD D2 04       6030          CALL  MSGO
04B7 21 F5 CF       6040          LXI   H,MT1
04BA 01 6B 05       6050          LXI   B,MSR2
04BD CD D2 04       6060          CALL  MSGO
04C0 C9             6070          RET
04C1                6080 *
04C1 E5             6090 MCLEAR   PUSH  H        * ERASE MESSAGE
04C2 C5             6100          PUSH  B
04C3 21 CC CF       6110          LXI   H,MS1
04C6 0E 20          6120          MVI   C,20H
04C8 36 20          6130 MCL1     MVI   M,' '
04CA 23             6140          INX   H
04CB 0D             6150          DCR   C
04CC C2 C8 04       6160          JNZ   MCL1
04CF C1             6170          POP   B
04D0 E1             6180          POP   H
04D1 C9             6190          RET
04D2                6200 *
04D2 0A             6210 MSGO     LDAX  B        * PUT MESSAGE POINTED TO
04D3 FE FF          6220          CPI   0FFH       BY BC UP ON SCREEN, BEG-
04D5 C8             6230          RZ               INNING AT LOCTION HL
04D6 77             6240          MOV   M,A
04D7 03             6250          INX   B
04D8 23             6260          INX   H
04D9 C3 D2 04       6270          JMP   MSGO
04DC                6280 *
04DC 0A             6290 MSGO     LDAX  B        * SAME AS MSGO, BUT WITH
04DD FE FF          6300          CPI   0FFH     * INVERTED VIDEO
04DF C8             6310          RZ
04E0 F6 80          6320          ORI   80H
04E2 77             6330          MOV   M,A
04E3 03             6340          INX   B
04E4 23             6350          INX   H
04E5 C3 DC 04       6360          JMP   MSGO
04E8                6370 *
04E8 20 2A 20 2A    6380 MNAME    ASC   ' * * THE GAME OF CHASE * * '
     20 54 48 45
     20 47 41 4D
     45 20 4F 46
     20 43 48 41
     53 45 20 2A
     20 2A 20
0503 FF             6390          DB    0FFH
0504 20 43 41 55    6400 M1       ASC   ' CAUTION - ROBOT NEAR! '
     54 49 4F 4E
     20 2D 20 52
     4F 42 4F 54
     20 4E 45 41
     52 21 20
051B FF             6410          DB    0FFH
051C 20 59 4F 55    6420 M2       ASC   ' YOU HAVE BEEN DESTROYED! '
     20 48 41 56
     45 20 42 45
     45 4E 20 44
     45 53 54 52
     4F 59 45 44
     21 20
0536 FF             6430          DB    0FFH
0537 20 43 4F 4E    6440 MWIN     ASC   ' CONGRATULATIONS - YOU HAVE WON! '
     47 52 41 54
     55 4C 41 54
     49 4F 4E 53
     20 2D 20 59
     4F 55 20 48
     41 56 45 20
     57 4F 4E 21
     20
0558 FF             6450          DB    0FFH
0559 2D 2D 53 43    6460 MSR      ASC   '--SCORE--'
     4F 52 45 2D
     2D
0562 FF             6470          DB    0FFH
0563 59 4F 55 3A    6480 MSR1     ASC   'YOU:'
0567 FF             6490          DB    0FFH
0568 52 4F 42 4F    6500 MSR2     ASC   'ROBOTS:'
     54 53 3A
056F FF             6510          DB    0FFH
0570 54 48 45 20    6520 ENDB1    ASC   'THE ROBOTS HAVE WON  -  : '
     52 4F 42 4F
     54 53 20 48
     41 56 45 20
     57 4F 4E 20
```

```
      20 2D 20 20
      3A 20
05BA FF                 6530          DB      0FFH
05BB 59 4F 55 20        6540 ENDB2    ASC     #YOU HAVE BEATEN THEM -  : #
      48 41 56 45
      20 42 45 41
      54 45 4E 20
      54 48 45 4D
      20 2D 20 20
      3A 20
05A5 FF                 6550          DB      0FFH
05A6 48 49 54 20        6560 ENDB3    ASC     #HIT ANY KEY TO PLAY AGAIN.....#
      41 4E 59 20
      4B 45 59 20
      54 4F 20 50
      4C 41 59 20
      41 47 41 49
      4E 2E 2E 2E
      2E 2E
05C4 FF                 6570          DB      0FFH
05C5                    6580 *
05C5 20 4C 45 56        6590 MDIFF    ASC     # LEVEL OF DIFFICULTY (0-9)?#
      45 4C 20 4F
      46 20 44 49
      46 46 49 43
      55 4C 54 59
      20 28 30 2D
      39 29 3F
05E0 FF                 6600          DB      0FFH
05E1                    6610 *
05E1                    6620 SP       EQU     6
05E1                    6630 PSW      EQU     6
05E1                    6640 STAT     EQU     0
05E1                    6650 DATA     EQU     1
05E1                    6660 RDA      EQU     40H
05E1                    6670 STACK    EQU     0650H
05E1                    6680 RCORN    EQU     0CCF6H
05E1                    6690 DCORN    EQU     0
05E1                    6700 ECORN    EQU     2
05E1                    6710 HEIGHT   EQU     0DH
05E1                    6720 WIDTH    EQU     19H
05E1                    6730 LOWD     EQU     DCORN+1
05E1                    6740 LOWE     EQU     ECORN+1
05E1                    6750 HID      EQU     DCORN+HEIGHT-1
05E1                    6760 HIE      EQU     LOWE+WIDTH+WIDTH-4
05E1                    6770 MS1      EQU     0CFCCH
05E1                    6780 MS2      EQU     0CD10H
05E1                    6790 SCR      EQU     0CFBDH
05E1                    6800 SRE      EQU     0CF77H
05E1                    6810 MSY      EQU     0CFB8H
05E1                    6820 MT1      EQU     0CFF5H
05E1                    6830 ENDM1    EQU     0CD10H
05E1                    6840 ENDM3    EQU     0CD90H
05E1 34 12              6850 SH       DW      1234H
05E3 78 56              6860          DW      5678H
05E5                    6870 DFST     DS      1
05E6                    6880 RSCORE   DS      1
05E7                    6890 YSCORE   DS      1
05E8                    6900 YOUP     DS      2
05EA                    6910 ROB1     DS      2
05EC                    6920 ROB2     DS      2
05EE                    6930 ROB3     DS      2
05F0                    6940 ROB4     DS      2
05F2                    6950 ROB5     DS      2

B1      0058    0570
BEGIN   0000    2080 4080
BOTM    0056
CHEK    0210    2760
CLEAR   044E    0150 0280 3820 3940 5590
DATA    0001    0130 2030 3720
DCORN   0000    0300
DEATH   0285    1930 2470
DECH    027E    2710
DECV    025E    2750
DFST    05E5    0270 065C 3290 3470 3520
DIFF    001B
DN      0364    1840 2990 3010 4260 4280 5360 5380
DONE    03A7    4440
ECORN   0002    0310
END     03E6    1970
END1    0331    3770
END2    0350    3920
END3    0359
ENDB1   0570    3960
ENDB2   05BB    3840
ENDB3   05A6    4050
ENDOA   030F
ENDM1   CD10    3830 3950
ENDM3   CD90    4040
ENTER   0007    2060
FLAS1   0220    2620
FLAS2   0224    2560
FLAS3   022C    2600
FLASH   021E    2490
HEIGH   000D    0410 0580
HID     000C    4560
HIE     0031    4640
HORIZ   039C    43A0
INP     01A9    02A0 1680 2020
L1      006A    0630
LF      0369    1800 31a0 4250 4270 5320 5340
LIMIT   03A9    0770 1400 1570
LL      037B    1820
LOOP1   007D    0780 0850
LOWD    0001    4520
LOWE    0003    4600
LP1     03BE    4410
LP2     0390    4390
LP3     039F    4470
LR      03B1    1860
LSIDE   006B
M1      0504    5670
M2      051C    5740
MCL1    04CB    6160
MCLEA   04C1    5440
MDIFF   05C5    0230
MNAME   04EB    0190
MS1     CFCC    0220 5660 5730 5780 6110
MS2     CD10    0180
MSG1    045E    5500
MSG2    046C    3190
MSGO    04D2    0200 0240 3850 3970 4060 5910 6030 6060 6270
MSGQ    04DC    5680 5750 5800 6360
MSR     0559    5900
MSR1    0563    6020
MSR2    0568    6050
MSY     CFB8    6010
MT1     CFF5    6040
MWIN    0537    5790
NEAR    040C    1670
NEAR2   0443    5290 5310 5330 5350 5370 5390 5410 5430
NEAR3   0442    5520
OVER    0301    3240 5850
OVER1   0309
PAN1    02D5    3490
PAN2    02E2    3550
PAN3    02C8    3310
PAN4    02ED    3370
PAN5    02B4    3360
PANIC   029D    1880
PANN    02EF    3460 3610
PANOK   02E4    3510 3560
PLOT    0387    0330 0360 0450 0510 0540 0600 0790 1420 1590
PSW     0006    3280 3620 3650 3660
R1      004C    0480
RCORN   CCF6    0870 0890 0910 0930 0950 0970 0990 1010 1030 1050 1070
                1090 1110 1130 1150 1170 1190
```




```
RDA     00F0    2010 3700
RDEAD   0209    2120 2170 2220 2270 2320
RMDV1   01CE    2130
RMDV2   01DD    2180
RMDV3   01EC    2230
RMDV4   01FB    2280
RMDVE   01BF    1960
RND     03BF    0710 0740 1340 1370 1510 1540 3330 3580
ROB1    05EA    1230 2110 2150 3390 5050
ROB2    05EC    1250 2160 2200 3410 5090
ROB3    05EE    1270 2210 2250 3430 5130
ROB4    05F0    1290 2260 2300 5170
ROB5    05F2    1310 2310 2350 5210
ROBOT   00F1
ROSE    009C
RSCOR   05E6    0120 3200 3220 3750 3890 3980 5960
RSIDE   0048
RT      036C    1720 3150 4230 4290 5280 5400 5420
RTOP    03C7    5000
SCORE   0492    0160 0290 3230 5840
SCR     CFBD    5940
SEED    0074
SEEK    0238    2140 2190 2240 2290 2340
SEL     0115    1220 1240 1260 1280 1300 1410 1450
SH      05E1    4720
SP      0006    0140
SRE     CF77    5890
STACK   0650    0140
START   002C    3260 5870
STAT    0000    2000 3690
SUBH    0271    2690
SUBV    0241    2730
T1      0038    0400
TOP     0036
UL      0375    1780
UP      035F    1760 2930 2960 4220 4240 5300
UR      036F    1740
VERT    038B
WAIT    02F7    3250 3710 3810 3930 4070 5860
WIDTH   0019    0320 0490
WIN     0476    5250
Y1      019B    1900
YMOV1   0158
YMOVE   0158    1330 1490 1980 3670
YOU     0137    1320 1580 1620 3640
YOUP    05E8    1640 1690 1950 2820 3080 5270
YSCOR   05E7    0110 3780 3860 4010 5810 5830 5920
```

OBJECT LISTING

```
0000: AF 32 E6 05 32 E7 05 DB 01 31 00 10 CD 4E 04 CD
0010: 92 04 21 10 CD 01 EB 04 CD D2 04 21 CC CF 01 C5
0020: 05 CD D2 04 CD A9 01 E6 0F 32 E5 05 CD 4E 04 CD
0030: 92 04 16 00 1E 02 06 19 CD B7 03 36 5B 13 CD B7
0040: 03 36 20 13 05 C2 38 00 06 0D 1D 1D 14 CD B7 03
0050: 36 5B 05 C2 4C 00 06 18 1D CD B7 03 36 20 1D CD
0060: B7 03 36 5B 05 C2 5B 00 06 0D 15 CD B7 03 36 5B
0070: 05 C2 64 00 3A E5 05 07 47 3E 1E 90 47 CD BF 03
0080: E6 0F 57 CD BF 03 E6 7F 5F CD A9 03 DA 7D 00 CD
0090: B7 03 7D E6 FE 6F 36 5B 05 C2 7D 00 21 F6 CC 36
00A0: 54 21 FA CC 36 59 21 FE CC 36 55 21 3B CD 36 5C
00B0: 21 3A CD 36 5E 21 3C CD 36 2F 21 76 CD 36 47 21
00C0: 7B CD 36 0D 21 7A CD 36 4B 21 7C CD 36 09 21 7E
00D0: CD 36 4A 21 BB CD 36 2F 21 BA CD 36 0B 21 BC CD
00E0: 36 5C 21 F6 CD 36 42 21 FA CD 36 4E 21 FE CD 36
00F0: 4D CD 15 01 22 EA 05 CD 15 01 22 EC 05 CD 15 01
0100: 22 EE 05 CD 15 01 22 F0 05 CD 15 01 22 F2 05 CD
0110: 37 01 C3 5B 01 CD BF 03 E6 0F 57 CD BF 03 E6 FE
0120: 5F CD A9 03 DA 15 01 CD BF 03 7E FE 20 C2 15 01
0130: 36 20 05 C8 23 5B 01 CD B7 03 E6 0F 57 CD BF 03
0140: E6 FE 5F CD A9 03 DA 37 01 CD B7 03 7E FE 20 C2
0150: 37 01 36 0F 22 E8 05 C9 CD 0C 04 CD A9 01 2A E8
0160: 05 36 20 FE 4A CC 6C 03 FE 55 CC 6F 03 FE 59 CC
0170: 5F 03 FE 54 CC 75 03 FE 47 CC 69 03 FE 42 CC 7B
0180: 03 FE 4E CC 64 03 FE 4D CC 81 03 FE 50 CC 9D 02
0190: FE 4B CA 9B 01 7E FE 20 C2 85 02 36 0F 22 E8 05
01A0: CD BF 01 CD E6 03 C3 5B 01 DB 00 E6 40 CA A9 01
01B0: DB 01 E6 7F FE 0D CA 07 00 FE 1B CA 00 00 C9 2A
01C0: EA 05 CD 09 02 DA CE 01 CD 3B 02 22 EA 05 2A EC
01D0: 05 CD 09 02 DA DD 01 CD 3B 02 22 EC 05 2A EE 05
01E0: CD 09 02 DA EC 01 CD 3B 02 22 EE 05 2A F0 05 CD
01F0: 09 02 DA F8 01 CD 3B 02 22 F0 05 2A F2 05 CD 09
0200: 02 DB CD 3B 02 22 F2 05 C9 7E FE 5B 37 CB 3F C9
0210: 7E FE 0F CA B5 02 FE 5B CA 1E 02 36 07 C9 16 A0
0220: 36 04 1E FF 1D C2 24 02 1E FF 36 84 1D C2 2C 02
0230: 15 C2 20 02 36 5B AF C9 36 20 E5 CD 71 02 E1 CD
0240: 7E 02 E5 CD 4D 02 E1 CD 5E 02 C3 10 02 7D E6 C0
0250: 6F EB 2A E8 05 7D E6 C0 93 4F 7C 9A 47 C9 07 DA
0260: 5F 03 79 0F DA 5F 03 AF 80 C2 64 03 81 C2 64 03
0270: C9 7D E6 3F 6F EB 2A E8 05 7D E6 3F 93 C9 CB F2
0280: 6C 03 C3 69 03 36 0C CD 6C 04 3A E7 05 3C 32 E7
0290: 05 CD 92 04 CD 01 03 CD F7 02 C3 2C 00 F5 3A E5
02A0: 05 E6 C2 CB 02 0E 07 CD BF 03 A1 FE 01 CA B4
02B0: 02 C3 ED 02 E5 2A EA 05 36 07 2A EC 05 36 07 2A
02C0: EE 05 36 07 E1 C3 EF 02 3A E5 05 DE 03 F2 D5 02
02D0: 0E 01 C3 E4 02 3A E5 05 DE 06 0E 03 F2 E2 02 C3
02E0: E4 02 0E 07 CD BF 03 A1 FE 01 CA EF 02 F1 C9 CD
02F0: 37 01 F1 F1 C3 5B 01 DB 00 E6 40 CA F7 02 DB 01
0300: C9 3A E7 05 FE 09 CA 31 03 3A E6 05 FE 09 C0 CD
0310: F7 02 CD 4E 04 21 10 CD 01 8B 05 CD D2 04 3A E6
0320: 05 C6 30 32 27 CD 3A E7 05 C6 30 32 29 CD C3 50
0330: 03 CD F7 02 CD 4E 04 21 10 CD 01 70 05 CD D2 04
0340: 3A E7 05 C6 30 32 27 CD 3A E6 05 C6 30 32 29 CD
0350: 21 90 CD 01 A6 05 CD D2 04 CD F7 02 C3 00 00 11
0360: C0 FF 19 C9 11 40 00 19 C9 2B 2B C9 23 23 C9 CD
0370: 5F 03 C3 6C 03 CD 5F 03 C3 69 03 CD 64 03 C3 69
0380: 03 CD 64 03 C3 6C 03 21 00 CC C5 7A E6 0F 06 40
0390: CA 9C 03 23 05 C2 90 03 3D C2 8E 03 7B E6 7F CA
03A0: A7 03 23 3D C3 9F 03 C1 C9 7A DE 01 37 FB 7A DE
03B0: 0C 37 F0 7B DE 03 37 F8 7B DE 31 37 F0 3F C9 C5
03C0: E5 21 E4 05 06 08 7E 07 07 07 AE 17 17 2D 2D 2D
03D0: 7E 17 77 2C 7E 17 77 2C 7E 17 77 2C 7E 17 77 05
03E0: C2 C7 03 E1 C1 C9 2A EA 05 7E FE 07 C8 2A EC 05
03F0: 7E FE 07 C8 2A EE 05 7E FE 07 C8 2A F0 05 7E FE
0400: 07 C8 2A F2 05 7E FE 07 C8 C3 76 04 2A E8 05 CD
0410: 6C 03 CD 43 04 CD 5F 03 CD 43 04 CD 69 03 CD 43
0420: 04 CD 69 03 CD 43 04 CD 64 03 CD 43 04 CD 64 03
0430: CD 43 04 CD 6C 03 CD 43 04 CD 03 CD 43 04 CD 03
0440: C1 04 C9 7E FE 07 C0 CD 5E 04 E1 C3 42 04 21 00
0450: CC 36 20 23 7C FE D0 C2 51 04 AF D3 CB C9 E5 C5
0460: 21 CC CF 01 04 05 CD DC 04 C1 E1 C9 21 CC CF 01
0470: 1C 05 CD DC 04 C9 21 CC CF 01 37 05 CD DC 04 3A
0480: E6 05 3C 32 E6 05 CD 92 04 CD 01 03 CD F7 02 C3
0490: 2C 00 21 77 CF 01 59 05 CD D2 04 3A E6 05 C6 30
04A0: 21 BD CF 77 3A E7 05 C6 30 11 40 00 19 77 21 BB
04B0: CF 01 63 05 CD D2 04 21 F5 CF 01 6B 05 CD D2 04
04C0: C9 E5 F5 21 CC CF 0E 20 36 20 23 0D C2 CB 04 C1
04D0: E1 C9 0A FE FF CB 77 03 23 C3 D2 04 0A FE FF C8
04E0: F6 B0 77 03 23 C3 DC 04 20 2A 20 2A 20 54 4B 45
04F0: 20 47 41 4D 45 20 4F 46 20 43 4B 41 53 45 20 2A
0500: 20 2A 20 FF 20 43 41 55 54 49 4F 4E 20 2D 20 52
0510: 4F 42 4F 54 20 4E 45 41 52 21 20 FF 20 59 4F 55
0520: 20 4B 41 56 45 20 42 45 45 4E 20 44 45 53 54 52
0530: 4F 59 45 44 21 20 FF 20 43 4F 4E 47 52 41 54 55
0540: 4C 41 54 49 4F 4E 53 20 2D 20 59 4F 55 20 4B 41
0550: 54 45 20 57 4F 4E 21 20 FF 2D 2D 53 43 4F 52 45
0560: 2D 2D FF 59 4F 55 3A FF 52 4F 42 4F 54 53 3A FF
0570: 54 4B 45 20 52 4F 42 4F 54 53 20 4B 41 56 45 20
0580: 57 4F 4E 20 20 20 20 3A 20 FF 59 4F 55 20 4B
0590: 41 56 45 20 42 45 41 54 45 4E 20 54 4B 45 4D 20
05A0: 2D 20 20 3A 20 FF 4B 49 54 20 41 4E 59 20 4B 45
05B0: 59 20 54 4F 20 50 4C 41 59 20 41 47 41 49 4E 2E
05C0: 2E 2E 2E 2E FF 20 4C 45 56 45 4C 20 4F 46 20 44
05D0: 49 46 46 49 43 55 4C 54 59 20 28 30 2D 39 29 3F
05E0: FF 34 12 78 56 00 00 00 00 00 00 00 00 00 00 00
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There's an iCOM Floppy Disk System for Everyone!

More Uses

People from every walk of life are adding iCOM® Floppy Disks to their microcomputers for such diverse tasks as payroll, inventory control, mailing lists, game playing, record keeping, parts ordering . . .

We've uncovered some innovative applications, too: The sailboat architect who puts equations and algorithms on an iCOM disk to test his nautical theories; the student who has automated a bowling alley; the iCOM dealer who designed an environmental control system for a university.

More Speed

These users have found iCOM floppies to be much faster and more versatile than cassette or paper tape. With iCOM, programs can be loaded in seconds; files updated in minutes; hundreds of programs can be stored on a single disk.

More Models

iCOM has Frugal Floppies™, Dual Floppies, Microfloppies™ (using the new 5¼" diskette), and other new approaches to floppy disk systems. Each is hardware and software compatible with Altair™, IMSAI, Poly 88, Sol-20 and other microcomputers using the Altair S-100 bus format.

More Software

Then there's iCOM's famous software: Powerful field-proven FDOS-II with macro-assembler, string-oriented text editor, and file manager. Plus easy-to-use compatible 8K Disk BASIC. Each with super features such as: named variable length files, auto-file create, open and close, multiple merge and delete . . . and more.

More Backup

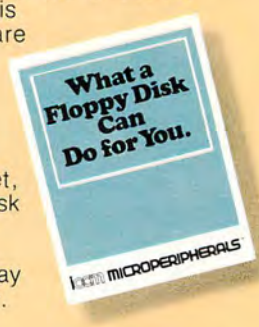
We've been building floppies for microcomputers for more than 3 years. Long before the rest. Thousands of systems are operating perfectly in the field. And we're part of Pertec Computer Corporation, one of the largest manufacturers of peripherals, microsystems, data entry products and data processing systems. We'll be around whenever you need us.

More Dealers

Maybe not in quantity, but in quality. We've chosen our dealer network carefully to assure you of assistance every step of the way. Our prices are right. Our delivery is fast. Our dealers are experienced and knowledgeable.

Must Reading

Our free booklet, "What a Floppy Disk Can Do for You" is must reading. Send for yours today or visit your dealer.



icom® MICROPERIPHERALS®

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CIRCLE INQUIRY NO. 18

UP AND RUNNING

TDL EQUIPMENT USED BY NEW JERSEY PUBLIC TELEVISION TO PROCESS NEW JERSEY GUBERNATORIAL PRIMARY ELECTION RETURNS

John Montagna, computer engineer (above left), lead this successful network team in generating election results speedily, efficiently and reliably using predominantly TDL hardware and software. Montagna created three programs to get the job done. The text for a SWAPPER program was written and assembled using the TDL TEXT EDITOR and Z80 RELOCATING MACRO ASSEMBLER. The SWAPPER text and all debugging was run through TDL's ZAPPLE MONITOR. The relocatable object code was punched onto paper tape. A MAIN USERS program updated votes and controlled air display. An ALTERNATE USERS program got hard copy out and votes in. The latter two programs were written in BASIC. Montagna modified the ZAPPLE BASIC to permit time-sharing between the two USERS programs.

Four screens were incorporated, two terminals entered votes as they came in and were used to call back votes to check accuracy. Montagna called on the power and flexibility offered by TDL's ZPU board and three Z-16 Memory boards.

Montagna's setup worked constantly for over four hours updating and displaying state-wide and county-wide results without flaw.

"I chose TDL because they have all the software to support their hardware, and it's good; it has the flexibility to do the job."
John Montagna

We salute John Montagna and NEW JERSEY PUBLIC BROADCASTING for spearheading the micro-computer revolution.

TDL's XITAN SYSTEMS have the capacity to do similar tasks for you. Write to us for XITAN information and the name of your nearest TDL dealer.

TECHNICAL DESIGN LABS

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